

Committee on Faculty Welfare, Diversity & Academic Freedom (FWDAF)

Tuesday, September 17, 2013

2:00 pm – 3:30 pm, KL 324

Documents found at UCMCROPS/FWDAF1314/Resources**AGENDA**

I. Consent Calendar

Action requested: Approval of the agenda

II. Guest – De Acker, [Campus Ombuds](#)

Introduction and overview of services provided to faculty

III. Chair's Report – Rudy Ortiz**A. Welcome FWDAF members****B. Issues for the AY 13-14 year**

- i. Systemwide representatives. University Committee on Faculty Welfare (Linda Cameron), University Committee on Academic Freedom (Sean Malloy), and University Committee on Affirmative Action and Diversity (Rudy Ortiz)
- ii. Faculty recruitment process in the Schools
- iii. Faculty retention issues
- iv. Faculty mentoring program
- v. ["Terminal Year" granted to faculty denied tenure](#) **Page 4**
- vi. APM 210. Meet with CAP chair to discuss assessment of faculty contributions to diversity, and develop and implement diversity worksheet.
- vii. Additional member of FWDAF. Committee Bylaws state the committee needs at least five members which is the current number of members; however, the committee can decide if it wants another member to attend systemwide meetings if necessary.
- viii. Meeting schedule. Suggested schedule is September, December, January, and April (last meeting with the Chancellor and Provost).

IV. [Physics Proposal for the Establishment of a Graduate Program](#) Page 11

Background. At the end of AY 12-13, the Physics graduate group submitted a proposal to establish a graduate program leading to the M.S. and Ph.D. degrees. All Senate standing committees are asked to review and comment. The proposal is available at [UCMCROPS/FWDAF13/Resources/Review Items - Campus](#)

Action requested: Review proposal. If FWDAF chooses to opine, the committee analyst will draft a memo with comments to Senate Chair López-Calvo and transmit to senatechair@ucmerced.edu. Comments are due on Friday, September 20.

V. [Course Buyout Policy](#) Page 188

Background. A draft policy was developed by the Provost and School Deans in 2012. The Provost and Deans are seeking approval of the policy for five years after which a re-evaluation of the policy will occur. Policy is available at [UCMCROPS/FWDAF1314/Resources/Review Items - Campus](#)

Action requested: Discuss draft policy. If FWDAF chooses to opine, committee analyst will draft a memo with the compilation of comments and transmit to Senate Chair López-Calvo at senatechair@ucmerced.edu. Deadline for comments is Monday, September 23.

VI. [SACAP Charge](#) Page 192

Background. Senate-Administration Council on Assessment and Planning (SACAP) was established in 2009 as a joint effort between the Academic Senate and the Administration. Provost Peterson has requested a revision to the council's charge. The charge is available at [UCMCROPS/FWDAF1314/Resources/Review Items - Campus](#)

Action requested: Review revised charge. If FWDAF chooses to opine, the committee analyst will draft a memo with comments to Senate Chair López-Calvo and transmit to senatechair@ucmerced.edu. Comments are due on Monday, September 30.

VII. Informational Items – Rudy Ortiz

A. UC CARE - Tier 1 health care providers for campuses without medical centers.

[Documents available at UCMCROPS/FWDAF1314/Resources/Correspondence/UCFW/UC Care](#). Please do not distribute.

B. UC Online Education - copyright concerns for faculty.

C. UC Retirement Program – increasing employer contributions.

VIII. Other Business

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August 19, 2013

'Terminal Year' Granted to Those Denied Tenure Can Be Awkward, if Not Risky



Christine Prichard for The Chronicle

By Robin Wilson

Debra M. Moriarity recalls making a promise to Amy Bishop when her colleague pointed a 9-millimeter pistol at her head. "I have helped you before," Ms. Moriarity told her. "I can help you again."

But the offer may have sounded hollow to Ms. Bishop, an assistant professor of biology at the University of Alabama at Huntsville.

After all, her colleagues, including Ms. Moriarity, a full professor of biochemistry, had already voted against Ms. Bishop's tenure bid. Despite that negative decision, Ms. Bishop continued working in the department and attending faculty meetings for months. At one of those meetings, in February 2010, she

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opened fire, killing three professors and wounding three others. Her gun jammed when she pointed it at Ms. Moriarity, ending the killing spree.

Like most academics who are denied tenure, Ms. Bishop was granted a final year to stay on at the university. The official reason for the "terminal year," as it's known in the profession, is that tenure decisions are often made in the spring, when faculty job openings for the following academic year have already been filled. To give people on their way out enough time to search for another post, almost all colleges pay tenure-track professors to continue teaching and performing research for another year. The longstanding policy, a concept unique to academe, is endorsed by the American Association of University Professors and spelled out in the association's 1940 Statement of Principles on Academic Freedom and Tenure.

But the terminal year, while rarely as treacherous as it proved to be in the Huntsville case, is often a painful and uncomfortable time, both for those who are on their way out and those who remain. Few universities offer guidelines to help lame-duck professors deal with the rejection, navigate their final year in a department that no longer wants them, and chart a future.

A wrongful-death lawsuit filed against former Huntsville administrators by relatives of two of the three tenured professors Ms. Bishop killed calls into question the wisdom of the terminal year. It alleges that Huntsville's top administrators knew Ms. Bishop was volatile during that time and protected themselves from confrontations with her but failed to take steps to safeguard her colleagues from danger. Ms. Bishop was [sentenced last year](#) to life in prison for the murders.

Lawyers for the university's former provost, Vistasp M. Karbhari, who is now president of the University of Texas at Arlington, have asked a judge to dismiss the lawsuit, saying there is no evidence that top administrators knew Ms. Bishop

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was dangerous before the killings. But Douglas Fierberg, a lawyer for the relatives of the slain professors—Adriel D. Johnson and Maria Ragland Davis—updated the lawsuit with a filing last month that provides phone records as well as recordings of calls that he says support the suit's allegations. In the new filing, Mr. Fierberg and other lawyers for the relatives accuse university administrators of not only ignoring the safety of others on the campus but also trying to cover up the steps they took to shield themselves by calling campus police.

"Bishop's later rampage was not only foreseeable," says the lawsuit, "it was foreseen by those who protected themselves and no one else."

Little Guidance

Ms. Bishop's case is clearly unique. Not only was the outcome extreme, but she had a violent background. The same year she committed the Huntsville murders she was indicted for the 1986 shooting death of her brother, which had previously been considered accidental. Her lawyer has said she has long suffered from mental illness.

"While it is true that you can get an Amy Bishop, most people spend their terminal year doing the best they can to complete their responsibilities and look for another job," says B. Robert Kreiser, who retired this month as a senior program officer at the AAUP. "And it doesn't cause harm to the institution."

But that doesn't mean that universities couldn't do a better job of helping professors deal with tenure denial. Robert Meier, director of the employee-assistance program at Ohio State University and president of the International Association of Employee Assistance Professionals in Education, says his office offers group sessions to help young professors make their way through the strain of trying to earn tenure. But Ohio State, like most other universities, provides no formal program for those who ultimately fail.

When professors who've been denied tenure do come to his office for help, says

Mr. Meier, they often show the typical symptoms of profound loss. "It's like breaking up after a long relationship or losing a loved one," he says. "There is the denial, this couldn't be happening to me, then anger because this has been taken away from you, and then some bargaining. They sometimes see us as being a negotiator on their behalf, and we have to rapidly explain to them that's not what we're here to do."

The experience of being denied tenure can be so traumatic that some professors never fully recover, even if they do manage to move on. It has been 14 years since Kimberly A. Hannula was denied tenure in geology at Middlebury College. But even after all this time, if she had it to do over again, she says, she would not attend graduate school in science, to avoid the wrenching experience of being turned down for tenure.

"If Vermont fell off the map in a giant earthquake, I wouldn't mind," says Ms. Hannula, who is now a full professor of geology and assistant dean of natural and behavioral sciences at Fort Lewis College, in Colorado.

Ms. Hannula didn't seek counseling after she was denied tenure. "There is so much a culture of the strong individual going off and doing brilliant things," she says "and counseling is seen as a sign of weakness."

Middlebury did change her course schedule during the extra time she stayed on after her tenure bid was rejected, she says. Instead of teaching a freshman seminar, "where I think I would have told them their assignment was to apply to transfer someplace else," says Ms. Hannula, she was assigned two small upper-level geology courses with students she had already taught.

Raymond A. Coish, a professor of geology at Middlebury who was chairman of the department when Ms. Hannula was denied tenure, says the college changed her teaching assignment because professors who offer a freshman seminar are expected to continue to advise those students after the seminar ends, and Ms.

Hannula would not be available to do so. In addition, Mr. Coish says the college often lightens the teaching load of professors during their terminal year to give them ample time to look for a new job and to ensure that "they leave the college with good feelings."

Many institutions alter the work assignments of professors denied tenure to ease possible conflicts with students and colleagues. Sometimes the professor who is denied tenure may not teach a course that explores sensitive issues, like race, gender, or religion, where he or she may have run into trouble with students before. Sometimes administrators change committee assignments to keep a professor from coming into conflict with those who may have been involved in the battle for tenure. "If you have trigger points you know can set a person off, that have caused conflict to a level of being uncomfortable, you say, Let's remove that for everyone," says Barbara O. Korner, dean of the College of Arts and Architecture at Pennsylvania State University.

Sometimes institutions do decide that keeping on a person who's been denied tenure is not wise. "In some cases it's so bad we say, We can't put up with this, it's not worth it," says Susan Welch, dean of the College of Liberal Arts at Penn State. "So we say, Take your salary and go away."

That's what happened, says Ms. Welch, when one Penn State professor who was denied tenure threatened to "go home and get my gun," she says. Administrators called the campus police and the university told the professor not to return, even though it paid the professor for the remainder of the year.

Fixated on Appeal

During the months she spent at Huntsville after she was denied tenure, in the spring of 2009, Ms. Bishop taught one section of anatomy and physiology and another of neuroscience, and attended routine faculty meetings. But she seemed to spend most of her time fixated on appealing the tenure decision and badgering her colleagues to change their minds, faculty members have said.

To many of her fellow professors, her campaign felt like harassment, recalls Ms. Moriarity, who at the time of the shootings had been urging Ms. Bishop to move on and begin applying for other academic jobs. Ms. Moriarity had even offered to write recommendation letters and to continue doing research with Ms. Bishop after she'd landed another position. But Ms. Bishop, who had earned a Ph.D. in genetics from Harvard University, seemed unable to come to terms with her colleagues' decision that she did not belong at Huntsville.

In an affidavit she wrote after the murders, Ms. Bishop described what happened at Huntsville. Three months before the shootings, she wrote, she telephoned the office of David Williams, who was then the university's president, and asked for a meeting but was turned down. She told the president's assistant she was going to come to the office anyway that afternoon and wait to talk to him or to the provost, Mr. Karbhari. In her affidavit, Ms. Bishop wrote that as she sat outside the administration building in her car after making the phone call, she saw the president and the provost slip out the back door, accompanied by security officers. She never went up to their offices that day.

Lawyers for the former provost, Mr. Karbhari, have argued that the wrongful-death case, which originally named only him, should be dismissed because he was under no obligation to warn Ms. Bishop's colleagues about her behavior. He had no indication, his lawyers said, that she might turn violent. His lawyers have said that Ms. Bishop's version of the events can't be trusted and that there was no contact between Huntsville administrators and the campus police regarding Ms. Bishop.

But the new filing—which also names Huntsville's former president, Mr. Williams, who is now dean of engineering at Ohio State—says telephone records support Ms. Bishop's version of events. The lawsuit says the records show that the president's office notified campus security around the time of Ms. Bishop's call and referred to an earlier request that a guard be stationed near the administrators'

offices. The phone recordings also show that the president's assistant described the professor's possible visit to the campus police as a "danger situation" and a "safety issue." During the hours after Ms. Bishop claims to have seen the president and provost fleeing their offices, phone records show calls between the president's office and his home phone.

According to the lawsuit, campus regulations at Huntsville require employees to refer people they suspect are "experiencing emotional, mental, or psychological instability" to the campus police, who "in turn will work with counseling professionals, in order to protect the lives and safety of persons on campus." That never happened in Ms. Bishop's case, says the lawsuit.

Instead, says the suit, Huntsville administrators have "painted a fictional picture of a random, unexpected, and unforeseeable event" while "denying the existence of any police records or concerns about Bishop before the massacre."

In her affidavit, Ms. Bishop says she called Ms. Moriarity and told her about the administrators' refusal to see her that day. She also recalls telling Ms. Moriarity that the administrators were probably afraid she would do something violent. Ms. Moriarity told The Chronicle she replied that she doubted that was the case, and remembers telling Ms. Bishop that the administrators probably just didn't have time to meet with her.

Ms. Moriarity says despite what happened at Huntsville, she still supports the concept of a terminal year for those denied tenure.

But "the year needs to have more active support from the university, with immediate counseling on how to go about applying for another job, plus emotional counseling," Ms. Moriarity adds. "People need to feel like they aren't hanging out there with everyone running away from them."

**A proposal for a program of graduate studies in physics for the MSc and PhD
degrees**

University of California, Merced

May 12th 2013

Contact information:

Professor Linda S. Hirst, Group Chair
School of Natural Sciences
University of California, Merced
5200 North Lake Road
Merced, CA 95343
Phone: (209) 228-4617
Email: lhirst@ucmerced.edu

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A proposal for a program of graduate studies in physics for the MSc and PhD degrees University of California, Merced

SECTION 1. INTRODUCTION

This proposal is to establish the **Physics Graduate program** leading to the M.S. and Ph.D. degrees at the University of California, Merced. The physics and chemistry graduate emphasis was established in 2005 with students enrolled in the Individual Graduate Program (IGP), which was approved by the Coordinating Committee on Graduate Affairs (CCGA). Since its inception, the IGP has been established as the interim vehicle to launch interdisciplinary graduate education at UC Merced. The physics group currently consists 21 PhD students and 12 senate faculty.

Physics is the study of the natural world at its most fundamental. It ranges from the study of the very tiniest pieces of matter and energy, including molecules, atoms, photons, and subatomic particles, to the study of the entire universe. Insights in physics have revolutionized our society. It is hard to imagine an area of science or engineering that has not been profoundly affected by fundamental developments in physics. One need only think of the harnessing of electricity, the invention of the transistor, and the discovery of the laser.

The present strengths in physics at UC Merced are centered on three broad areas of research, Condensed matter physics, Atomic, molecular and Optics physics (AMO) and Biophysics. Over the past six years the physics group has begun to mature into a highly successful and cohesive research and teaching unit.

1.1 The mission and objectives of the physics graduate program

The mission of the Physics graduate program at UC Merced is to train our next generation of scientific leaders. Our graduates will be well prepared to conduct and communicate independent research at the knowledge frontier, advancing fundamental understanding of the world around us and using physics to solve important problems in society.

Program Learning outcomes

Graduates of the Physics PhD program will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Have the experimental, theoretical, and/or computational skills** necessary to conduct and lead independent responsible research and contribute to knowledge in their chosen subfield.
- 3) **Identify new research opportunities**, which may cross traditional discipline boundaries, plan effective strategies for pursuing these opportunities and conduct research that makes a new contribution to knowledge in their chosen subfield of physics and solve important problems in society.
- 4) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, including in a classroom setting to expert and non-expert audiences. This includes the publication of original research results in peer reviewed scientific journals.

Graduates of the Physics Masters program (type II) will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Be proficient in professional skills** necessary to lead a productive career in physics or a related career.
- 3) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, to expert and non-expert audiences.

Physics faculty research covers a core program of sub-disciplines and students receive training in the fundamental physics they will need for success through traditional lectures. This knowledge is the first step to becoming a PhD candidate. We encourage all our students to select a research advisor and graduate project as early as possible and our philosophy is that the real training to becoming an independent scientist happens through the mentoring and guidance of the research advisor.

In the near future the physics faculty reasonably expects to grow at a rate of 1-2 additional faculty hires per year, allowing us to develop interesting new graduate-level courses for our program while still satisfying teaching needs at the undergraduate level. Space for new faculty will become available in the Science and Engineering Building 2, as well as through renovations of existing laboratory and office space at the Castle facility.

1.2 The physics group emphasis areas

1. Atomic, Molecular, and Optical Physics

UC Merced is building a strong research emphasis in atomic, molecular, and optical (AMO) physics. Interest and developments in this field have surged in the last twenty years, primarily due to advanced experimental techniques. These developments have been recognized by several recent Nobel prizes: for ion trapping and atomic clocks (1989; Ramsey, Dehmelt, Paul), for atomic cooling and trapping techniques (1997; Chu, Cohen-Tannoudji, Phillips), for the creation of Bose-Einstein condensates (2001; Cornell, Ketterle, Wieman), and most recently for advances in quantum optics (2005; Glauber, Hall, Haensch).

The modern trend in AMO science is toward greater control over quantum systems such that quantum coherence is maintained and quantum processes can be resolved. This includes working at very low temperatures, at ultrashort time scales, and with very high spectroscopic precision. Modern techniques can now routinely address single atoms, single photons, and single qubits (the quantum analog of a bit). The technological implications for such precise control over the fundamental building blocks of ordinary matter are as yet unimagined, but the promise is great. By analogy, the laser, which in some sense is a “Bose-Einstein” condensate of photons, has impacted almost every area of technology and medicine. The UC Merced program in AMO physics currently comprises five faculty (Sharping, Mitchell, Tian, Ghosh and Scheibner) and complements the research programs in condensed matter physics and chemistry.

2. Condensed Matter Physics

Condensed Matter Physics at UC Merced is a broad, interdisciplinary program focusing on “condensed” phases of matter. These phases range from simple solids and liquids to metallic and semiconductor nanomaterials to exotic condensed phases such as the superconducting phase exhibited by conduction electrons in certain materials, and the ferromagnetic and antiferromagnetic phases of spins on atomic lattices. The intellectual scope of this program is vast, and includes an understanding of the optical, electrical, mechanical, and transport properties of materials, encompassing the nano- to the macro-scale.

Research in condensed matter can be harnessed to design new materials such as magnets, semiconductors, ferroelectrics, superconductors, polymers, and liquid crystals, used for applications in a wide variety of disciplines including efficient energy conversion, ultra-fast optics, quantum information processing, and structural materials, to name a few. **Condensed matter physics is the field in which the largest number of physicists are working today and represents a vitally important area for undergraduate and graduate student training.** Currently there are seven faculty (Ghosh, Gopinathan, Scheibner, Hirst, Brown, Winston and Tian) contributing to this focus area.

3. Biophysics and Soft Matter Physics

Experimental, computational and theoretical methods and techniques from Physics have played a major part in recent advances in our understanding of biological systems. Examples include cutting-edge imaging techniques that have provided snapshots of biological molecules and their complex assemblies in action and have also led to dramatic improvements in medical imaging. The ability to control matter at the smallest scales, using for example optical and magnetic tweezers, has allowed us to study and manipulate biological processes at the single molecule level. Theoretical and computational modeling are leading the way in our efforts to understand protein folding/misfolding, the functioning of molecular motors and enzymes, ion channels, membrane structure and dynamics as well as the dynamics of complex biochemical and neural networks. The result of advances in biological physics will be a better understanding of normal and pathological processes at both the molecular and systems level. Equally important, from a soft matter physics perspective, studies of biological systems examples of complex, self-assembling, non-equilibrium systems has led to new and interesting physics including emergent properties in dynamical networks, self-assembled, self-replicating systems, the thermodynamics of “active” systems and an atomistic understanding of complex macromolecules. **Biophysics is the most rapidly growing area in physics research attracting both seasoned physicists from several different subfields and large numbers of entering students.**

To develop a competitive research program in biophysics requires individuals who have had extensive training in doing biophysical research, hailing from either traditional physics subfields such as condensed matter, polymer or statistical physics or from more interdisciplinary backgrounds including specifically biophysics, materials or bioengineering. A strong core of faculty in this area has already been formed, (Hirst, Gopinathan, Brown, Xu), with two additional hires we expect to become a highly competitive program.

1.3 Program Development: Current and Projected Size

1.3.1. Students

Since the program began, 15 graduate students have advanced to candidacy in the PhD program and as of Summer 2012, 5 Ph.D. students and one M.S. student have graduated. Our students have been successful in winning competitive fellowships and awards, presented work at local, national and international research conferences, and published their research in peer-reviewed journals. Another important metric for success is the proportion of entering students that attain their graduate degree and this progress will be documented as the program grows. In addition we will look at publication rates and quality, competitive graduate student fellowships, grants and awards.

Table 1 - Physics faculty with research areas and current graduate students

Faculty Member	Research Areas	Current Physics Graduate Students*
Eric Brown	Fluid Dynamics Condensed Matter Materials Chemistry and Physics Energy Sciences	Joshua Casara K.M. Rifat Faysal
Raymond Chiao (Emeritus)	Atomic, Molecular, and Optical Physics Condensed Matter Physics	Luis Martinez Nathan Inan
Sayantani Ghosh	Atomic, Molecular, and Optical Physics Condensed Matter Physics Materials Chemistry and Physics Nanoscale Science and Technology Energy Sciences	Georgiy Shcherbatyuk (graduated 2012) Andrea Rodarte Christopher Ferri Jussi Amaral
Ajay Gopinathan	Biophysics Condensed Matter Physics	David Ando Katherine Copenhagen
Linda Hirst	Biophysics Condensed Matter Physics	Ronald Pandolfi Zachary Nuno Nathan Melton
Kevin Mitchell	Atomic, Molecular, and Optical Physics	Roxanne Moran Sulimon Sattari
Michael Scheibner	Atomic, Molecular, and Optical Physics Condensed Matter Physics	Mark Kerfoot Cyprian Czarnocki Cameron Jennings
Jay Sharping	Atomic, Molecular, and Optical Physics Biophysics	Chenji Gu (graduated 2012) Alison Huff Leily Kiani Alessandro Castelli
Lin Tian	Atomic, Molecular, and Optical Physics Condensed Matter Physics	Xiuhao Deng Dan Hu
Roland Winston	Atomic, Molecular, and Optical Physics Energy Sciences	Melissa Ricketts
Jing Xu	Biophysics Quantitative Biology Nanoscale Science and Technology Atomic, Molecular, and Optical Physics Condensed Matter Physics	Pending

*Note some students are jointly advised by physics faculty members - these students are listed only once. Students not yet assigned to a group are not included.

Table 2 - student growth in the physics PhD program

Academic year	Number of new students			Total enrollment		
	Domestic	International	Total	Domestic	International	Total
2005-2006	1	0	1	1	0	1
2006-2007	0	0	0	1	0	1
2007-2008	0	4	4	1	4	5
2008-2009	4	1	5	5	5	10

2009-2010	4	3	7	8	8	16
2010-2011	3	0	3	11	6	17
2011-2012	4	0	4	13	6	19
2012-2013	9	2	11	21	7	28
2013-2014 (projected)			10			36
2014 – 2015 (projected)			14			38
2015 – 2016 (projected)			16			40

Table 3 - Publications by Physics graduate group students with physics faculty

1. "Dynamics of spontaneous emission of quantum dots in a one-dimensional cholesteric liquid crystal photonic cavity" A.L. Rodarte, G. Shcherbatyuk , L.Shcherbatyuk, L.S. Hirst and S. Ghosh, submitted (2012)
2. Controlling photo-induced spectral changes in CdSe/ZnS quantum dots by tuning inter-dot energy transfer. G. V. Shcherbatyuk , P. Talbot, and S. Ghosh, Appl. Phys. Lett. 100, 212114 (2012)
3. "Directed assembly and in-situ manipulation of semiconductor quantum dots in liquid crystal matrices" A. Rodarte, C.G.L. Ferri , C. Grey, L.S. Hirst and S. Ghosh, EMERGING LIQUID CRYSTAL TECHNOLOGIES VII: Proceedings of SPIE, 8279H (2012)
4. "Spectral and polarization modulation of quantum dot emission in a one-dimensional liquid crystal photonic cavity" A. Rodarte , C. Grey, L.S. Hirst and S. Ghosh, PHYS REV B, 85, 035430 (2012)
5. V. Sharypov, X. Deng , and L. Tian , "Parametric four-wave mixing toolbox for superconducting resonators", Phys. Rev. B 86 , 014516 (2012).
6. Anomalous photo-induced spectral changes in CdSe/ZnS quantum dots. G. V. Shcherbatyuk , R. H. Inman, and S. Ghosh, J. Appl. Phys. 110, 053518 (2011).
7. X. Deng, Y. Hu , and L. Tian , "Universal quantum degeneracy point for superconducting qubits", preprint online arXiv:1101.2942 (2011).
8. Y. Hu and L. Tian , "Deterministic generation of entangled photons in superconducting resonator arrays", Phys. Rev. Lett. 106 , 257002 (2011).
9. Gu, C. , Goulart, C., Sharping, J. E. (2011). Cross-phase-modulation-induced spectral effects in high-efficiency picosecond fiber optical parametric oscillators. Optics Letters, 36(8), 1488-1490.
10. "Cylindrical luminescent solar concentrators with near-infrared quantum dots", R. H. Inman, G. V. Shcherbatyuk , D. Medvedko, A. Gopinathan, and S. Ghosh, Optics Express, Vol. 19, Issue 24, pp. 24308-24313 (2011)
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1.3.2. Faculty

In the seven years that the physics program has been active and the UC Merced campus open, physics faculty have been extraordinarily successful in generating research funds, publishing their work and growing their research laboratories. As can be seen from the table below a large amount of extramural funds have been obtained from federal, state and private sources. A particularly impressive achievement considering the junior level of many of the faculty. The group's research and achievements point to our strengths in the core areas of condensed matter physics, biophysics, soft matter and atomic, molecular and optical physics (table XX).

As for all other UC campuses, the procedures for recruitment of new faculty, merit increases and promotion to tenure at UC Merced follow the system-wide Academic Personnel Manual (APM). UCM also has campus-specific procedures described in the Merced Academic Personnel Policies & Procedures (MAPP), which are consistent with the system-wide APM. The MAPP is available at:

<http://academicpersonnel.ucmerced.edu/mapp.asp> The MAPP is updated at the end of every academic year, in consultation with the UCM Academic Senate.

As at other UC campuses, UCM also has a Committee on Academic Personnel (CAP), which reviews all appointment, merit and promotion cases submitted by the Schools, and makes recommendations to the Executive Vice Chancellor/Provost and Chancellor. The UCM CAP has been in existence since 2002. Before UCM had its own faculty, the UCM CAP consisted only of faculty from other UC campuses. Since 2004, the UCM CAP began to include UCM faculty in its roster. The current UCM CAP has six external members (from UCB, UCI, UCSB) and five members from UCM. The external members include former chairs from the CAP of their respective campuses, and assure that UCM conforms to the expectations for research and teaching that are typical at other UC campuses.

Table 4 – The Physics graduate group faculty (see table 1 for areas of expertise)

Senate faculty rank	Number
Full professor	1 + 1 emeritus
Associate professor	5
Assistant professor	4
Lecturer with potential security of employment	1

The physics faculty have been extremely successful in obtaining extramural funding with five members receiving prestigious NSF CAREER awards since 2008. The table below documents grant funding received by the group since 2005 when the program was initiated. These figures indicate a very healthy research environment for graduate students and future growth. Publications by individual faculty are too numerous to tabulate here but details can be found in the CV section at the end of this proposal in Appendix B. Physics faculty have been very successful in securing extramural funds and a representative selection of grants can be seen in table 5. The growth and success of the physics faculty is notable, given the fact that the majority of the membership up to this point have been junior faculty. Future growth will be towards a more senior faculty overall as a larger proportion of the group is promoted to associate and full Professor on the strength of their strong research, teaching and service records.

Table 5 - Selected extramural grants over \$100k with physics faculty PIs*

Grant	dates	Amount
L. Tian (Single PI Award), NSF Faculty Early CAREER Award, “CAREER: Quantum Optics in Nanoscale Devices Approaching the Quantum Limit”	06/2010 - 05/2015	\$450,000.
L. Tian (Single PI Award), NSF CISE Program, “SHF: Small: Global Manipulation in Solid-State Quantum Information Processing-Protocols and Implementation”	06/2009 - 05/2012,	\$300,967
Hirst, Linda S (Principal Investigator), " CAREER: Self-Assembly of Polyunsaturated Lipids and Cholesterol In The Cell Membrane," NSF	2008 - 2013	\$575,000
Hirst, Linda S (Principal Investigator), "IMI:International Center for Materials Science (ICMS)," NSF	2009 - 2014	\$100,000
Kevin Mitchell – NSF CAREER: Chaotic transport - from fundamental theory to applications in atomic physics		\$400,000
Jay Sharping – Compact fiber-parametric devices for biophotonics applications, Air Force, Office of Scientific Research.	2009-2012	\$304,514
Jay Sharping - Wideband Quantum Frequency Conversion in Optical Fibers: Enabling Transparent Quantum Information Processing, DARPA.	2008 - 2010	\$150,678
Ajay Gopinathan - McDonnell Foundation, “Biological Transport in Complex and Dynamic Environments”		\$301,702
Ajay Gopinathan – NSF, “Stochastic Transport in Biology: From Molecules to Ecosystems”	2010 - 2013	\$600,000
Eric Brown – NSF – CAREER: “Large-Scale Structures in Turbulent Dynamo Experiments with Liquid-Metal Suspensions”	2013-2018	\$518,000
Sayantani Ghosh – NSF – CAREER: “Investigation of Spatial and Temporal Scales of Cooperative Spin Clusters in Doped and Undoped Geometrically Frustrated Magnets”	2011- 2016	\$442,000
Roland Winston – “California Advanced Solar Technologies Institute”	2010-2015	\$2,250,000
Roland Winston - California Energy Commission: PIER Concentrating Solar Thermal project,	2006-2008	\$1,350,000

* For space reasons **only a selection of PI grants above \$100k** are listed, physics faculty have also received a large amount of additional funding Co-PIs and in the form of smaller grants.

1.4 Relationship to Existing UC Merced Programs and Academic Plans

Graduate education in physics is presently delivered through the Physics graduate emphasis area. Some physics faculty also are members or collaborators with faculty belonging to graduate groups in Bioengineering and Small Scale Technologies (BEST) and Quantitative and systems biology (QSB). Faculty members are also active in other self-organized interdisciplinary research groups allowing collaboration and cross-disciplinary projects. Their participation in these other groups is driven entirely by their research interests and will not be affected by the formation of the Physics group.

The small size of the physics faculty does limit the number of graduate courses we can offer, and we will make use of courses from other graduate programs to round out our course offerings and maintain the interdisciplinary flavor of our program. Many courses in Applied Mathematics, Chemistry, BEST, Electrical Engineering and Computer Science are suitable as electives for our graduate students. Electives outside the group should be reviewed and approved by the Educational Policy Committee, but it is expected that this committee will approve a broad range of courses if they are rigorous courses that have a clear connection to the student's research.

The Stem Cell Consortium (SCC) is a group of UC Merced biologists and bioengineers that are focused on understanding the mechanisms that control cell fate decisions and also on ways to predict cell behavior (www.stemcells.ucmerced.edu). SCC faculty and UC Merced have received over \$8M in research funding from CIRM and this funding has included support to build the new Stem Cell Instrumentation Foundry (SCIF). SCIF is a research facility dedicated to the microfabrication of lab-on-a-chip and quantitative analysis of stem cells and their progeny. Although not directly working in stem cell research, all physics students have access to SCIF, which includes state-of-the-art microscopy facilities, a clean room and sample characterization and fabrication equipment for lab-on-a chip technologies. The facility is currently used by Hirst, Ghosh and Xu.

The **Health Sciences Research Institute (HSRI)** is a new ORU on campus designed to catalyze new research on complex human health issues. HSRI is composed of junior and senior faculty from the Schools of Natural Sciences, Engineering, and Social Sciences, Humanities and the Arts, including Hirst and Gopinathan from the physics group. This group provides interactive opportunities between faculty, seed funding for collaborations and new projects and student training opportunities in health related research.

1.5 Interrelationship with other UC or Regional Institution Programs

1.5.1 Other physics Programs in California.

There are many physics graduate programs in the UC system and details of those programs are listed in the table below. The new proposed program at UC Merced is distinctive in its interdisciplinary research focus. The unique environment at UC Merced has fostered many collaborations between physicists and chemists, engineers and biologists. We are also unique in our focus on biophysics and soft matter science. UC Merced has already hired 4 physicists in this field (Hirst, Gopinathan, Brown, Xu), in addition several others (Ghosh, Sharping, Mitchell, Winston) collaborate on soft matter related projects. Our group will be unique in both the UC system and California with an emphasis in this area. **This emerging research strength represents a promising avenue towards distinction.**

Table 6 - A Tabular List Contrasting California Graduate Research Programs In physics

Ph.D Program	Enrolled	Areas of Emphasis & Number of Faculty Associated with Each	PhD Program	Enrolled	
Cal Tech	20	Astrophysics Observational (9) Astrophysics Theory (6) Atomic Molecular Optical (2) Biophysics (3) Condensed Matter (9) Cosmology (4) Elementary Particle Experiment (8) Elementary Particle Theory (7) Gravitational Physics (8) Mathematical Physics (2) Nuclear Physics (1) Quantum Optics & Information (3)	UC Berkeley	40	Theoretical Astrophysics (6) Theoretical Condensed Matter and Materials Physics (5) Theoretical Nonlinear Dynamics, Plasma and Beam Physics, and Complex Systems (4) Theoretical Particles and Fields (10) Relativity & Gravitation (2) Experimental Astrophysics (13) Biophysics (5) Experimental Condensed Matter Physics (15) Nuclear Physics (8) Experimental Particles and Fields (8) Plasma and Fusion (4)
Stanford	42	Theoretical Astrophysics and Cosmology (5) Theoretical Condensed Matter (6) Theoretical Particle Physics (10) Atomic, Molecular, & Optical Physics (5) Experimental Condensed Matter Physics (5) Experimental Particle Physics (5) Experimental and Observation Astrophysics and Cosmology (10)	UC Davis	20	Computational Physics (3) Condensed Matter Physics (17) Cosmology & String Theory (6) Particles and Fields (11) Relativity & Gravitation (1) Astrophysics (9) Nuclear Physics (4) Physics and other Science Education (1)
USC	71	Astronomy (2) Atomic and Molecular Physics (2) Biological Physics (6) Condensed Matter Physics (13) Computational Physics Cosmology (1) Laser Physics (4) High Energy Physics (6) NanoBioPhysics (1) Quantum Information Science (15) Space Science (1)	UC Irvine	23	Biological Physics (5) Theoretical Particle Physics (6) Experimental Particle Physics (9) Medical Physics (5) Theoretical Condensed Matter Physics (9) Experimental Condensed Matter Physics (12) Plasma Physics (7) Astrophysics & Cosmology (11)

UC San Diego	26	Acoustics (1) Astrophysics (7) Theoretical Biophysics (3) Theoretical Condensed Matter Physics (8) History & Philosophy of Physics/Science Nonlinear Dynamics and Complex Systems (4) Theoretical Plasma and Fusion (2) Statistical & Thermal Physics (6) Astronomy (13) Experimental Biophysics (7) Experimental Condensed Matter Physics (13) Nuclear Physics (1) Experimental Plasma and Fusion (4) Polymer Physics/Science (1)	UC Riverside	29	Theoretical Biophysics (2) Theoretical Condensed Matter Physics (5) Theoretical Particles and Fields (3) Astronomy (5) Atomic, Molecular, & Optical Physics (1) Experimental Biophysics (1) Experimental Condensed Matter Physics (3) Environmental Physics (2) Fundamental Precision Measurements (2) Joint Programs (1) Nano Science and Technology (7) Nucleon Structure (2) Optics (2) Experimental Particles and Fields (2) Relativistic heavy-ion physics (2) Surface Physics (3)
UC Santa Barbara	27	Theoretical Astrophysics (4) Theoretical Biophysics (7) Theoretical Condensed Matter Physics (6) High Energy Physics (6) Relativity & Gravitation (2) Experimental Astrophysics (6) Experimental Biophysics Experimental Condensed Matter Physics (11) Particles and Fields (7) Polymer Physics/Science (1) Statistical & Thermal Physics (3)	UC Santa Cruz	11	Theoretical Particle Physics (2) Experimental Particle Physics (7) Theoretical Condensed Matter Physics (2) Experimental Condensed Matter Physics (2) Materials Physics (2) Biophysics (1) Theoretical High-Energy Astrophysics (3) Experimental High-Energy Astrophysics (2) Cosmology (1)
UC Los Angeles	23	Theoretical Astrophysics (10) Theoretical Biophysics (2) Condensed Matter Physics (5) Low Temperature Physics (1) Experimental Astrophysics (11) Atomic, Molecular, & Optical Physics (2) Experimental Biophysics (3) Experimental Condensed Matter Physics (9) High Energy Physics (8) Nuclear Physics (2) Particles and Fields (1) Plasma Physics, Space Physics, Astrophysics (4)			

1.5.2 Cooperation or Competition with other Institutions.

The UC Merced physics group recognizes the excellence of our sister campuses and seeks to complement and extend that excellence. In the early stages of the program, ties with other campuses afford UCM graduate students a broader array of coursework and faculty advising expertise than will be available at UCM as a stand-alone institution. For example in 2009 students enrolled in a quantum field theory course

that was offered at UC Berkeley. Some physics graduate student Candidacy Committees have a members that are faculty at the sister UC campuses.

1.6 Program Administration

The Merced campus was initially set up with no disciplinary departments. The faculty in the School of Natural Sciences recently (Fall 2011) organized themselves into smaller, discipline based units in which they hold their appointments and Bylaw 55 departmental voting rights. All of the founding faculty of the physics graduate group hold their faculty appointments in the Physics bylaw 55 unit. All of the faculty in this proposed graduate program currently belong to the Physics emphasis under the IIGP, and a number also belong to other graduate groups. When approved, the physics graduate group will have its administrative home in the Graduate Division as do all other graduate programs at Merced.

The program will be administered by a group chair and three standing committees as detailed in the bylaws (Appendix E). The group chair is appointed by the Dean of the Graduate

Division and normally serves a three-year term, which may be renewed. The Executive Committee, which includes the group chair, is elected by vote of the group. It makes recommendations on membership in the group, appoints the other standing committees, and develops and implements policy in areas not clearly within the domain of the other committees. The Admissions Committee is primarily responsible for student recruitment and decisions on admission. The Educational Policy Committee establishes and guides the group's educational programs and requirements, approves elective courses, and handles student petitions for time extensions, course waivers, *etc.* It also conducts annual program assessments and oversees the self-study associated with formal program reviews. The membership committee oversees applications for group membership by faculty. The current physics Chair is Associate Professor Linda Hirst. Currently the duties of the and membership, educational policy committees are taken care of by the Executive committee due to low faculty numbers. When sufficient numbers allow these committees will be populated as per the physics group bylaws.

1.7 Program Evaluation Plan

The graduate group structure is meant to instill a culture of interdisciplinary education and research. Given the startup nature of UC Merced, and the limited array of formal graduate course offerings, it will be critical to obtain regular feedback from the students and faculty who participate in the program.

Physics will assess the learning outcomes of its graduate students through required annual committee meetings specifically addressing progress towards the program learning outcomes. These yearly evaluations will help guide the student through the year until his or her next committee meeting and allow us to track training effectiveness on a student-by-student basis. Additionally, publications, student presentations at research conferences, student success rate (attrition rates, number of probationary cases, time to graduation, what our students do after graduation), can also be used as program assessment tools. The formal assessment plan is detailed in Appendix C.

Regular meetings of the physics faculty are conducted in order to discuss general affairs, define problems and to initiate solutions. The executive committee also meets on an *ad hoc* basis to address any pressing concerns for individuals or the program as a whole. The physics group will collect data annually and self-review on the required program review cycle, consistent with the university's graduate program review policies. Institutional review occurs on a 7 year cycle as per UC Merced graduate program review policies.

1.8 Review and Approval Procedures

The Graduate and Research Council (GRC) of the UC Merced Academic Senate has developed procedures for faculty wishing to propose the formation of new graduate groups.

At the campus level, the present proposal was first approved by the faculty involved in the proposed program following consultation with faculty in related graduate emphasis areas. The Dean of Natural Sciences, who will be responsible for providing resources for the program, was consulted and provided a letter of support. The proposal was then reviewed by the GRC for academic review and the Senate Committee on Academic Planning and Resource Allocation, the Executive Vice-Chancellor, and the Graduate Dean for comment. The GRC then voted to approve the proposal and sent it to CCGA for review. Because of the newness of our campus, elevation of an existing graduate emphasis area to a stand-alone graduate program requires that the program undergo Substantive Change review by our accrediting body (WASC). The attached GRC procedures refer to a number of WASC-related issues.

SECTION 2. PROGRAM OF STUDY

2.1 Admissions Procedures and Requirements

All persons seeking admission to graduate standing must make formal application for admission through the Graduate Division's on-line application system. Applications are reviewed by the Admissions Committee, which makes recommendations on admission to Graduate Studies; the Dean of Graduate Studies makes final decisions on admission. The deadline for receipt of applications is January 15 for enrollment in the Fall semester. Applicants are encouraged to contact individual faculty members about their areas of research and teaching interests prior to applying.

Materials to be submitted:

- The complete official application form;
- The application fee;
- All official university/college/junior college transcripts;
- An official Graduate Record Exam (GRE) score report. Only the general tests are required, but the subject test in physics is also recommended;
- Three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher;
- Official score reports from the Test of English as a Foreign Language (TOEFL) if the applicant's native language or language of instruction is other than English.

The minimum requirement for graduate admission to UCM is a bachelor's degree, or any other degree or certificate which the Graduate Council accepts as equivalent, and a grade point average no lower than 3.0 on a 4.0 scale. This minimum will be waived only under circumstances where the applicant has demonstrated strong academic skills subsequent to their undergraduate studies. Performance on the GRE, accomplishments in undergraduate research, and letters of recommendation will also be evaluated as important determinants of an applicant's potential for success in graduate education.

Foreign students from non-English speaking countries are required to attain a minimum score on the TOEFL exam as required by UC Merced policy for admission to graduate programs. Students from non-English speaking countries will normally be interviewed by telephone by a member of the Admissions Committee in order to evaluate English proficiency.

2.2 General Requirements for Advanced Degrees

2.2.1 Residency

In accordance with SR 682 and 686, the minimum residency requirement for any advanced degree is two semesters. The minimum residency requirement for the Ph.D. degree is four semesters. Before advancement to candidacy Ph.D. students must be registered in regular University courses as a full-time student for at least two semesters. M.S. students must be registered as a full-time student for at least one semester before advancement to candidacy. M.S. students must be in residency for at least one semester after advancement to candidacy before conferral of the degree. For the purposes of determining residency, only the Fall and Spring semester will be counted; however, the summer semester may be counted in evaluating students on academic probation. Residency is established by satisfactory completion of at least 12 units of graduate coursework (including research) per term. Ordinarily, a graduate student shall not receive credit for more than 12 units of graduate courses in any semester. The physics graduate group only accepts full time students. Exceptions will only be granted for students in the non-thesis Masters Degree program (Section V.B.) with the permission of the graduate group Chair, in consultation with the Executive Committee.

2.2.2. Scholarship

Graduate students must maintain at least a 3.0 grade-point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0, or who is judged not to be making satisfactory progress toward the degree by his or her graduate advisor or faculty committee, will be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be dismissed from the graduate program.

Specific scholarship requirements are as follows:

- 1 Only courses in the 100 and 200 series in which the student receives grades of “B” or above, or “S” may be counted in satisfaction of the requirements for advanced degrees. A course in which a student receives a “C” or “D” or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.
- 2 Candidates must maintain an average of at least three grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Students must maintain an average grade point of 3.0 for advancement to candidacy and conferral of the degree.
- 3 Courses graded “S/U” will not be counted in determining grade point averages.
- 4 Students must make satisfactory progress on their programs of study as determined by their graduate research advisor.

2.2.3. Faculty Committees For Advanced Degrees

The graduate advisor, normally in consultation with the student and other program faculty, recommends appointment of faculty members to advise on and supervise the student’s dissertation research as part of their examination committees. Final approval of the membership on these committees rests with the Dean of Graduate Studies.

Advanced degree committees in the Physics group normally consist of four members. One is the student’s major professor, two are other UC Merced faculty members in the group (one of whom is appointed as Chair), and one is from outside the group. This outside member may be a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the graduate advisor should submit a brief statement indicating the appointee’s affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the graduate advisor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Dean of Graduate Studies for review and approval.

A student may opt to choose a major professor from outside of the physics group faculty (for example in applied math or chemistry). In such a case a nominal additional advisor from the physics group will be assigned in addition to the regular committee membership.

All members of the committee must be in attendance for Ph.D. qualifying and final examinations or Master's comprehensive oral examination (Plan II). All members of the committee must approve the Master's thesis (Plan I) or Ph.D. dissertation. If a committee member’s absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also be justified by a substantial change in the student’s thesis topic or may be required by the departure of a committee

member from the university. When membership changes must be made, the graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The reason must be acceptable to the Dean of Graduate Studies.

2.3 Programs Of Study

2.3.1 Masters Degree (Type II)

Students may be admitted to the graduate program in Physics to work towards a Masters Degree (M.S.). Additionally, a Ph.D. student who has been in residence for at least two semesters, is in good academic standing, and has completed at least four of the core courses may petition the Admissions Committee to pursue a terminal M.S. degree. The recipient of a M.S. degree is understood to possess knowledge of a broad field of learning that extends well beyond that attained at the undergraduate level, but is not necessarily expected to have made a significant original contribution to knowledge in that field.

Students are normally admitted to the graduate program in Physics to work toward the Ph.D. degree. The Physics group has established the following requirements for the M.S. degree. Each M.S. student has a committee with at least three members.

- Complete at least two semesters of full-time academic residence (12 units minimum) at UC Merced;
- Pass the preliminary examination
- Complete at least 24 semester hours of upper-division and graduate course work with a cumulative grade-point average of at least 3.0. At least 16 semester hours must be from regular, letter-graded lecture or discussion courses, while the remaining 8 hours may be research or similar courses;
- Pass a comprehensive oral examination administered by the faculty committee. This examination will test the student's understanding of the main concepts in the field at the graduate level.

In addition, the M.S. program requires attendance at physics seminars and M.S. students are recommended to take research units (PHYS 295), attend journal clubs and group meetings to help fulfill their unit requirements. Many of the mandatory Physics courses are “letter grade only”.

Graduate students should be aware that grades obtained of B– may land them in a state of unsatisfactory degree progress, as they must maintain an overall GPA of 3.0, and their semester GPA must not remain below 3.0 for two consecutive semesters. Graduate students should also be advised that S/U grades do not count towards GPA calculation by the registrar.

2.3.2 Doctor of Philosophy Degree

The Doctor of Philosophy degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residence or the completion of fundamental courses. The recipient of a Ph.D. degree is understood to possess thorough knowledge of a broad field of learning and to have given evidence of distinguished accomplishment in that field; the degree is a warrant of critical ability and powers of imaginative synthesis. The degree also signifies that the recipient has presented a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

The Physics group has established the following requirements for the Ph.D. degree:

- Complete at least four semesters of full-time academic residence (12 units minimum) at UC Merced;

- Complete the required courses with a letter grade of at least "B" in each course ("S" in seminar courses graded S/U);
- Serve as a teaching assistant for at least one semester;
- Pass a preliminary examination;
- Pass the oral Ph.D. qualifying examination;
- Present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field.

2.3.3. Selection of A Graduate Research Advisor

The heart of the Physics Ph.D. program is the completion of a piece of original scientific research leading to the preparation and defense of a Ph.D. thesis. To this end, each student should discuss research interests and possible Ph.D. projects with faculty in the group as early as possible, and select a graduate research advisor early during the first year of study. Selection of a graduate research advisor must be approved by the graduate group and must occur before the student's faculty committee can be constituted. The student and the graduate research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. Students will be assigned an initial advisor when they first enroll, unless the student has already chosen an advisor. This initial advisor will guide the student in their final choice of advisor.

2.3.4. Coursework Requirements

All Ph.D. students in the Physics group are required to take:

A. Core Course Requirements:

To be completed within the first four semesters.

- 1) PHYS 237 - Quantum Mechanics I
- 2) PHYS 210 - Electrodynamics
- 3) PHYS 212 - Statistical Mechanics
- 4) PHYS 205 - Classical Mechanics

B. Electives:

To be completed at any time during the PhD

- 1) An elective from the physics courses
- 2) A second elective which may be chosen from any graduate level courses in the school of Natural Sciences of Engineering

Physics electives include advanced physics courses such as Quantum Mechanics II, Condensed Matter Physics, Biophysics and any other PHYS 2XX courses available. They can also include graduate courses from the applied math, BEST or chemistry groups as long as they are 3 units and taken as a graded class. Any elective must be at least 3 units and we require at least one elective be a course outside the student's primary research area, which can be selected by discussion with the student's thesis advisor or the graduate group advisor for Physics.

C. In addition, students must take 1 unit of BEST/QSB294 Responsible Conduct of Research, 4 semesters of Physics seminar.

Other courses may be added to these lists as fulfilling the requirements at any time, as designated by the physics faculty.

The preliminary exam

All students in the group are required to pass a written preliminary examination that tests undergraduate-level understanding of the fundamental concepts in the field. This exam is administered twice each year, at the beginning of Fall and Spring semesters. Students may elect to take the exam for the first time at the start of either the first or second semester in residence. The exam may be taken once each time it is offered, but must be passed no later than the start of the fourth semester (a maximum of three attempts). Students who have not passed the exam by the start of their fourth semester may be subject to dismissal.

If a student would like to attain a waiver for any of the courses above, the rules are:

1. No waiver will be granted unless the student has passed the preliminary exam.
2. For waivers regarding elective courses, a student can only ask for a waiver on one elective course. All core courses can be waived if competency is demonstrated.
3. For a waiver on any of the courses, the student will need to attain the waiver from the faculty member who taught the course most recently. The faculty member granting the waiver will only do so if the student can successfully complete an exam in the course. This exam can be given at any time at the faculty and student's convenience, any time of the year. The final decision to grant the waiver will be taken by the Graduate Division.

Course electives must be regular graduate courses (not research or independent study). Courses offered by other graduate programs may be taken as electives but require approval of the major professor. Requirements for formal course work beyond the minimum are flexible and are determined by the individual student's background and research topic in consultation with the major professor.

All Physics graduate students must successfully complete their core course requirements with a grade of S or B or better. A student may petition the graduate chair for a single B- grade to be accepted. Graduate students should be aware that grades obtained of B- may land them in a state of unsatisfactory degree progress, as they must maintain an overall GPA of 3.0, and their semester GPA must not remain below 3.0 for two consecutive semesters. Graduate students should also be advised that S/U grades do not count towards GPA calculation by the registrar.

2.3.5. Research Proposal

Before the qualifying exam, the student will provide to the degree committee a written document that describes his or her research topic, summarizes progress to date, and outlines what he or she proposes to do, why it is relevant, and what will be learned. The format of the research proposal will be determined by the student in consultation with their adviser and committee; however the proposal must follow the format of a research proposal to a major funding agency in the student's area of research. The committee will review this document with the student and determine if the student has outlined a project that is appropriate for a Ph.D. If not, the student is given a month to rewrite the research plan. Once the research plan is approved the student may take the oral portion of the Qualifying Examination.

2.4. Ph.D. Qualifying Examination

All students in the Physics Ph.D. program are required to pass an oral qualifying examination before advancement to candidacy for the Ph.D. degree. Students are expected to take and pass the qualifying examination during their second year of graduate study unless they successfully petition the Educational Policy Committee to take it at a specific later date.

The qualifying examination may not be scheduled until the preliminary examination has been passed and the three core courses have been completed. The intent of this examination is to ascertain the breadth of a student's comprehension of fundamental facts and principles that apply in his or her major field of study. It will also determine the student's ability to think critically about the theoretical and practical aspects of the field. Accordingly, the examination should be focused on the student's field of research but may and should venture into other areas of scholarship that underlie or impinge on the thesis topic.

The examination committee is the same as the student's faculty committee. The major professor is a voting member of the committee, but will normally not participate in the examination except to provide technical clarifications as requested by the other members of the committee.

The date of the examination is arranged between the student and the committee chairperson. At least two weeks prior to the examination date, the student will provide to the committee a research proposal (typically approx ten pages) that describes his or her research topic, summarizes progress to date, and outlines what he or she proposes to do, why it is relevant, and what will be learned. The committee conducts the examination, and immediately thereafter submits the results of the examination to Graduate Division.

The committee members should include in their deliberations such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination. The student will be assigned either "Pass", "Conditional Pass" or "Fail". A unanimous decision is required for a "Pass". If not all members of the committee vote to pass, they must write a report explaining their decision and must inform the student of the reasons for the decision. A student who has not passed the examination may repeat the qualifying examination after a preparation time of at least three months. The examination must be held by the same committee except that members may be replaced, with the approval of the graduate advisor, for cause such as extended absence from the campus. Failure to pass the examination on the second attempt means that the student is subject to disqualification from further study for the doctoral degree.

2.5. Advancement To Candidacy

Upon successful completion of the examination, the student is given an application for advancement to candidacy by the examining committee chair. When it is filled out and signed by the graduate advisor and major professor, the student pays a candidacy fee and submits the form to Graduate Studies. Upon advancement to candidacy for the degree, the faculty committee is then charged to guide the student in research and in the preparation of the dissertation.

2.6. Publication Expectations

The final confirmation of the quality of a PhD dissertation is the ability to publish the research results in a peer-reviewed journal. The research field may influence the timing and work required to publish research results, making it difficult to define the number of publications required for each dissertation. For this reason, whether a student has made sufficient progress for the PhD will ultimately be determined by the student's advisor and thesis committee. The process of writing journal articles will be undertaken with the assistance and guidance of the student's research adviser. Published work should be presented to the graduate committee at the time of the student's thesis defense.

2.7 Dissertation And Final Examination

The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer reviewed journal. The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the faculty committee both the substance and the preparation of the dissertation well in advance of the planned defense date. Detailed instructions on the form of the dissertation and abstract may be obtained from the Graduate Studies office.

The student must provide a copy of the dissertation to each member of the faculty committee and allow each committee member at least four weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the dissertation is ready to be defended (although minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee. The date must be reported to the Dean of Graduate Studies, and one copy of the dissertation filed, no later than three weeks before the proposed date of the final examination.

The Ph.D. final examination consists of an open seminar on the dissertation work followed by a closed examination by the faculty committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written dissertation and the student's performance on the exam are of satisfactory quality to earn a University of California Ph.D. degree. The student will be assigned either "Pass", "Conditional Pass" or "Fail". A majority is required for a pass. Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the dissertation (conditional pass). In this case, the committee will select one member, normally the major professor, who will be responsible for approving the final version of the dissertation that is submitted to Graduate Studies.

2.8 Time to degree and annual evaluation

The Physics group places no strict limits on the length of time a graduate student may remain in residence. However, it is normally expected that successful completion of the Ph.D. will require no more than six years. In order to ensure satisfactory progress toward the degree, each student must meet with his or her faculty committee for an annual review of progress at a mutually agreeable time prior to the first day of each Fall semester. At least three members of the committee, including the major professor, must be present. The committee will review the student's progress toward the degree during the past year and develop a time table, mutually agreeable among student, major professor, and faculty committee, for completion of the remaining requirements. The annual report of the committee will become part of the student's record. Should the committee conclude that the student is not making satisfactory progress toward the degree, the student may be placed on academic probation.

2.9 Sample PhD Program

Table 7 - A sample timeline for the first 4 semesters of courses for a PhD student is shown below. A full description of the courses can be found in Section 5.

Fall 2013	Spring 2014	Fall 2014	Spring 2015
PHYS210 C (4)	PHYS237 C (4)	PHYS 238 (4)	PHYS248 (4)
PHYS205 C (4)	PHYS 212 C (4)		
PHYS 2XX (2)(writing)	PHYS 295 (3)	PHYS 295 (7)	PHYS 295 (7)
PHYS293 (1)	PHYS293 (1)	PHYS293 (1)	PHYS293 (1)

C = core class, brackets indicate units.

Table 8 - The physics group has developed the following sample guidelines for students to make good progress in the PhD program.

Year/semester	Activities
Year 1 (Semesters 1,2)	Learn about all research groups Take classes Pass preliminary exam (if applicable) Pick PhD advisor by end of second semester
Summer 1	Begin full time research with PhD advisor
Year 2 (Semesters 3,4)	Continue full time research with PhD advisor Take one class per semester if necessary Assemble faculty committee (beginning of third semester) Prepare for qualifying exam Schedule qualifying exam (during fourth semester) – defend PhD research proposal Apply for candidacy after passing qualifying exam (end of fourth semester)
Years 3	Conduct research Prepare manuscripts for publication Present work at a scientific conference; network for career
Years 4	Conduct research Continue publishing manuscripts Present work at a scientific conference; network for career.
Year 5 (Semesters 9,10)	Conduct research Present work at a scientific conference; network for career Declare candidacy for graduation (ninth semester) Defend and publish dissertation (tenth semester)

2.10 Teaching and Research Assistantships and Stipends

1. Newly admitted students will normally be supported as graduate TAs during their first two semesters in residence. After that, students will be supported as either TAs or GSRs depending on availability of TAs and the research advisor's funding situation.
2. New students who cannot be appointed as TAs because of limited English proficiency or lack of available TA positions may be appointed as GSRs for their first one or two semesters by mutual agreement of the student and the research advisor. The conditions of appointment will be the same as in #3 and #4 below. Normally all students will be required to TA for at least one semester as long as a suitable TA position is available. TA experience at other institutions could satisfy this requirement.
3. Graduate students serving as GSRs during the academic year will be appointed at 49.9% at the step for which the monthly stipend is most nearly equal to that for a first year TA in the Natural Sciences. There will be no additional or reduced pay during break periods.
4. Graduate students serving as GSRs during the summer will be appointed at the step determined in #3 above. The appointment will be 60% for students who have not yet been advanced to candidacy for the Ph.D. degree, and 70% for those who have been advanced to candidacy. Students are expected to spend the remainder of their time pursuing independent study toward the degree. GSRs do not accrue paid vacation time.
5. These policies should be revisited and revised as necessary on an annual basis.
6. Exceptions to these policies may be made at the recommendation of the student's research advisor, the graduate group chair, and the graduate dean.

SECTION 3. PROGRAM DEMAND AND JOB PROSPECTS

3.1 Student Demand

An important metric in evaluating student demand for the program will be in graduate applications and enrollments. With each passing year applications to the physics program have grown and the size of our program is now reaching the point where it will be limited by faculty numbers, not suitable applicants. This seems to point to the fact that there is a need for our program. In the early years getting the word out about the program was a limiting factor. We

believe that many potential applicants, have also been disinclined to apply to a program named “Physics and Chemistry” – our former name and are confident that enrollments will increase further with the name change. Our continued expansion in faculty numbers will also be an important factor in drawing in applications.

Table 9 – Projections for short term growth of the program

Academic Year	Number of New Students			Total Enrollment		
	Domestic	International	Total	Domestic	International	Total
2005-2006	1	0	1	1	0	1
2006-2007	0	0	0	1	0	1
2007-2008	0	4	4	1	4	5
2008-2009	4	1	5	5	5	10
2009-2010	4	3	7	8	8	16
2010-2011	3	0	3	11	6	17
2011-2012	4	0	4	13	6	19
2012-2013	9	2	11	21	7	28

Although there are several successful physics graduate programs across California, the table below demonstrates the huge numbers of applicants these programs receive. Each of these programs can only accommodate around 20-40 students each year but there are hundreds of applicants, many of which must be very well qualified. We believe that this represents clear evidence for a physics graduate program at UC Merced and that as the visibility of our program increases, many excellent candidates will apply and populate the program.

Table 10 – Graduate group admissions comparison with other UC campuses

	Academic Year	Number of Applicants	Number Admitted	Number Enrolled
Stanford	2012-2013	571	81	42
UCB	2011-2012	867	117	42
UCD	2011-2012	335	94	20
UCI	2012-2013	287	61	23
UCLA	2012-2013	352	71	23
UCR	2012-2013	311	80	29
UCSD	2011-2012	433	95	26
UCSB	2011-2012	651	108	27
UCSC	2011-2012	197	36	11

3.2 Opportunities For Placement Of Graduates

According to the U.S. Dept. of Labor's Bureau of Labor Statistics, in the decade between 2010 and 2020, Employment of physicists and astronomers is expected to increase by 14 percent.

“Competition for permanent research appointments, such as those at colleges and universities, is expected to be strong. Increasingly, those with a Ph.D. need to work through multiple postdoctoral appointments before finding a permanent position. In addition, the number of research proposals submitted for funding has been growing faster than the amount of funds available, causing more competition for research grants. Despite competition for traditional research jobs, prospects should be good for physicists in applied research, development, and related technical fields. Graduates with any academic degree in physics or astronomy, from bachelor’s degree to doctorate, will find their knowledge of science and mathematics useful for entry into many other occupations.”

U.S. Bureau of Labor Statistics, Employment Projections program

In addition, the next ten years will see massive retirements in all fields as baby boomers come of retirement age, increasing the number of open positions for physics M.S. and Ph.D. graduates. Furthermore, nearly 35% of Physical Science Ph.D.s are awarded to foreign-born students, the majority of which come from China and India, two of the world's largest economies. While some of these graduates find positions here, many of them return home due to the strong economic growth and numerous opportunities.

3.3 Importance To The Discipline and Society

The Ph.D. program emphasizes a research focused academic training and opens opportunities in a diverse array of careers. These include careers in college and university teaching and research, research oriented work in national laboratories and other government and public sector research institutions or leadership positions in industry. Additional career opportunities for PhD graduates include entrepreneurship, science policy advisors and science communication for the public.

The M.S. program has a more limited research focus owing to the shorter duration of the program and potential employment for graduates includes teaching at the community college level, as industry research associate, laboratory managers and other technical positions in national laboratories or industry.

A long term metric for the success of our graduate program will be the placement of students in full time employment in either an academic setting, industry and technology fields or jobs that require an advanced degree. The group will carry out exit surveys and track alumni career progress where possible.

Technological advances in science and engineering fields generally address important societal problems and needs, for example in energy research (solar power and alternative energy sources), communications (computer memory, smartphones, displays etc.) and sensing (detectors, biomedical devices). Fundamental physics plays an important role in every aspect of our modern lives. Without highly trained individuals in the basic sciences advancements for humanity will be limited in the future. Contributions close to home in the San Joaquin Valley will also be realized as some of our graduates will stay in the area, producing new businesses and enhancing educational capital in a traditionally poor, undereducated area.

3.4 Relationship Of The Program To Research And Other Professional Interests Of The Faculty

The program proposed is based entirely on the research of the faculty comprising the physics graduate group. All physics student research projects will be supervised by physics faculty and the research will be performed primarily in the laboratories of physics faculty. In the case that the lead advisor for a student is in another graduate group, such as chemistry or bioengineering, an additional faculty advisor will be assigned from physics to oversee progress.

3.5 Program Differentiation

Owing to the smaller number of faculty compared to existing programs, the physics graduate program has a more focused thematic content. Research concentrates on the areas of 1) condensed matter, 2) atomic molecular and optical (AMO) physics and 3) soft matter and biophysics.

Unique to programs in the UC system and California is a growing focus in soft matter physics. This emerging field will attract students to our campus. UC Merced is the home of Softmaterworld.org, a website for the soft matter community and founded by Prof Hirst (also the author of the textbook “Fundamentals of Soft Matter Science”). In this regard the group (including soft matter physicists Gopinathan and Brown with contributions from Xu and Ghosh) is becoming well known as a focal point for the field on the West coast.

Another distinguishing feature of the program is the built-in interdisciplinary focus and the faculty are building a strength in research at the interface between condensed matter and AMO physics (Ghosh, Scheibner, Sharping, Mitchell, Chiao).

To enhance interdisciplinarity, faculty are located in a building shared with chemistry, biology and engineering faculty. As well as research collaborations, which are common, students are encouraged to attend cross-disciplinary seminars and classes to enhance their degree experience.

SECTION 4. FACULTY

Physics faculty and their ranks are listed in Table 7, Section 1.3 and their areas of specialization in table 1. The Physics program faculty members are affiliated with the Schools of Natural Sciences (NS), and Engineering (SoE). Faculty CVs are compiled in Appendix A.

SECTION 5: COURSES

Table 8 summarizes current course offerings in the physics program. Frequencies of courses offered will vary depending on programmatic needs and student enrollment. The physics program has a core curriculum that must be delivered every year, along with elective courses that can be delivered at minimum once every two years. The Committee on Educational Policy (EPC) is responsible for establishing and guiding the educational programs of the Group. Per the physics Bylaws (Appendix E), the EPC will periodically conduct reviews of the programs, including the seven-year review. The EPC in consultation with the group faculty will determine changes in programmatic requirements of the physics graduate group. Current workload guidelines suggest that faculty teach a mixture of graduate and undergraduate courses over a three-year cycle. A proposed teaching plan with instructor assignments can be found in Appendix C along with syllabi for the physics core courses.

Table 11. Physics Graduate Level Courses

Course number	Title, units	Description	Recent Instructor(s)
PHYS 204	Biophysics [4]	Aims to give students an understanding of relevant physical principles for biological systems, introduce them to experimental and theoretical techniques of biophysics and to communicate the excitement of cutting-edge biophysics research. Topics include diffusion, fluids, entropic force, motor proteins, enzymes, nerve impulses, networks and evolution	Gopinathan
PHYS 205	Classical Mechanics [4]	Topics in classical mechanics, including Lagrangian and Hamiltonian formulations, Conservation Laws and Symmetry and the relationship, Calculus of variations and variational principle, Euler angles and rigid body dynamics, Oscillations and normal modes.	Scheibner
PHYS 210	Electrodynamics and Optics I [4]	Continuation of electrodynamics. Wave guides and resonant cavities, Multipole radiation, Relativistic charged particles in electromagnetic fields, Collisions between charged particles and radiation from moving charges with relativistic corrections, introductory magnetohydrodynamics.	Winston
PHYS 211	Electrodynamics and Optics II [4]	Theory and practical application of molecular quantum mechanics. Schrödinger equation and matrix representations of quantum mechanics; simple exactly solvable model problems; calculation of observable properties; vibrational and electronic wave functions; approximation methods; quantum mechanics of spectroscopy.	
PHYS 212	Statistical Mechanics [4]	Topics include: General principles of statistical mechanics including microcanonical, macrocanonical and grand canonical ensembles, fluctuations and equilibrium. Thermodynamics including Legendre transforms and Maxwell relations, fluctuations and stability and Landau theory. Quantum statistical mechanics including Bose-Einstein and Fermi-Dirac statistics.	Gopinathan
PHYS	Quantum	Introductory Quantum Mechanics starting with simple	Tian,

237	Mechanics I [4]	Quantum two-state systems and one dimensional problems, Uncertainty relations, Solution of Schrodinger's equation for important two and three dimensional physical situations, Angular momentum, identical particles and spin statistics. Hydrogen and multi-electron atoms.	Scheibner
PHYS 238	Quantum Mechanics II [4]	Perturbation methods, both stationary and time-dependent, Scattering, interaction with electromagnetic fields, Stark effect, Measurement theory and decoherence, Quantum Hall effect.	Tian
PHYS 241	Condensed Matter Physics [4]	An introduction to the physics of materials designed for graduate students in physics or chemistry. The course will cover traditional solid state physics and include topics in soft matter. This class will examine the relationship between microscope structure and bulk properties in different properties.	Hirst, Ghosh
PHYS 249	Introduction to Quantum Field Theory [4]	Introduces quantum field theory with a special emphasis on quantum electrodynamics (QED). Topics include canonical quantization of scalar fields, electromagnetic fields, perturbation theory and renormalization methods among others.	Chiao
PHYS 290	Current Topics in Physics and Chemistry [3]	Exploration of current research directions, problems, and techniques in molecular and materials chemistry, physics and engineering. Course format emphasizes student-led presentation, analysis, and discussion of reading assignments from the current and recent scientific literature. Topics determined by the instructor and changes each semester.	
PHYS 291	Physics and Chemistry Seminar [1]	Graduate seminar on current research in molecular and materials chemistry, physics, and engineering. Satisfactory/Unsatisfactory grading only.	NA
PHYS 292	Special Topics in Physics [1-4]	Treatment of a special topic or theme in Physics at the graduate level. May be repeated for credit. Laboratory included.	
PHYS 293	Physics Colloquium [1]	This is a colloquium series with talks on a wide range of research topics in Physics. Speakers for the colloquia are primarily invited researchers from other Institutions. Some of the seminars additionally showcase the research performed by UC Merced Physics faculty, post doctoral researchers and graduate students. This is a forum to introduce the undergraduate and graduate students to cutting edge research in Physics conducted on-site and elsewhere, and to give them an opportunity to meet researchers and faculty from other Universities/Research Institutions.	NA
PHYS 295	Graduate Research [1 - 15]	Supervised research. Permission of instructor required. S/U grading only.	Multiple sections each semester
PHYS 298	Directed Group Study [1 - 6]	Group project under faculty supervision. Permission of instructor required. S/U grading only.	

PHYS 299	Directed Independent Study [1 - 6]	Independent project under faculty supervision. Permission of instructor required. S/U grading only.	Multiple sections each Fall
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SECTION 6. RESOURCE REQUIREMENTS

6.1 Faculty FTE

The Physics group currently has 12 senate faculty including one emeritus which is sufficient to run the graduate program, provide the necessary courses, and fill out graduate research committees. Nevertheless, more faculty will benefit the group by allowing a broader range of courses and more faculty expertise in specific areas, and the graduate group plans to continue growing at a rate of at least 1-2 new faculty per year with a current search underway 2013-2014 and two hires planned for the following year..

6.2 Library Acquisition

The UC Merced library provides complete access for students and faculty to the combined collections of all of the University of California Libraries. Electronic access to extensive on-line information is available to all UC faculty and students through the California Digital Library.

The Leo and Dottie Kolligian Library integrates physical and digital collections. The resources and services available are accessible from computers connected to the campus network and to the Internet. Physics students have access to all commonly used journals in the physical sciences through this digital network and although the book collection is relatively small, can take advantage of the interlibrary loans system to obtain books relatively quickly. More rare journal articles can also be obtained through the interlibrary system.

6.3 Computing

Computation is an important aspect of physics research and with several theoretical/computational faculty (Mitchell, Gopinathan, Tian) this is an important resource for our group. Several high performance computational clusters have been created by Natural Science and Engineering faculty, and are typically available for computationally intense research topics by physics graduate students and their mentors. We currently have a small, 64-node campus computer cluster supported by faculty in chemistry, physics, and applied math and individual faculty have constructed their own resources based on start-up funding and grants. As the number of physics faculty involved in computational research increases, we expect to write a joint proposal for much more extensive computing infrastructure.

6.4 Space, Core Facilities and Equipment

All current physics faculty are currently located on the main UC Merced campus, either in the Science and Engineering 1 (SE1) building or the Classroom and Office building (COB). All experimentalists in the program are located in SE1. SE1 consists of over 100,000 ASF with laboratory and office space for 92 faculty and laboratory desk space for graduate students and postdoctoral researchers. The space is currently configured in a manner that mixes faculty from all scientific disciplines, an ideal collaborative environment for our program.

All core facilities and shared equipment are easily accessible in the Science and Engineering Building and at the UCM Castle Air Force Base satellite campus. Further faculty growth will require additional research space and the construction of new buildings at the UC Merced campus is ongoing, reflecting the growth of the campus at a steady pace.

Science and Engineering II building is slated for completion in Fall 2014. When SEII is complete, some Engineering faculty will move into it, freeing up space in SEI for additional Natural Science hires. Additional pieces of major shared instrumentation needed for a fully functioning program may be funded through contributions to startup costs, in some cases from donors, and by writing proposals. Our small group has already had some success with NSF instrumentation proposals: one of us (Ghosh) is co-PI on a

successful \$656,473 NSF-MRI grant to acquire a femtosecond laser system.

The physics research programs described above will require the continued development of research facilities. Good progress has been made in developing some useful research resources and are described below

Microfabrication Facilities: We have a modular cleanroom (Class 1000) as part of the Stem Cell Instrumentation Foundry (SCIF). This laboratory provides basic micro- and nano-fabrication capabilities (including photolithography, metal deposition, and etching). The SCIF is available for all UC Merced faculty. UCM can also utilize the Berkeley Microlab Core Facility for a fee. The Center for Micro- and Nanotechnology (CMNT) at LLNL has been a leader in micro- and nanotechnology to enable revolutionary growth in micro- and nano- scale sensors and actuators.

Electron Microscopy Facility: This UCM Core Facility is available to all members of the university, enabling scientists to perform traditional scanning and transmission electron microscopy (TEM), as well as specialized environmental SEM for hydrated, non-fixed biological samples.

Computational Resources: All students and faculty in the physics graduate group have access to a 30-node Linux cluster, each node consisting of dual 2.2 GHz AMD Opteron 248 processors with 2 gigabytes of RAM per node, and with an aggregate of 1.5 terabytes of disk space. Installed on this system are a variety of molecular modeling including Gaussian 03, Amber 9.0, and Gromacs 4.0.3.

Confocal and Fluorescence Microscopy: The Nikon C1 confocal laser scanning microscope is equipped with three lasers (red, green, and blue) and 12-bit digitization pixel depth for high resolution imaging and can support simultaneous 3 channel fluorescence for 3 color staining, 3-D imaging, fluorescence digital energy transfer, fluorescence recovery after photobleaching, time lapse studies, and spatial analysis. Confocal microscopy can be used to analyze colocalization, subcellular localization, protein expression, calcium signaling, apoptosis, and other life science applications that require high resolution and quantifiable imaging. UCM owns several microscopes for fluorescence and phase contrast microscopy, with filters for FITC, DAPI and rhodamine. The microscopes are connected to a CCD camera and are equipped with software for image acquisition and analysis.

SECTION 7. GRADUATE STUDENT SUPPORT

Physics graduate students are supported by several mechanisms. In principle, our goal is to provide full stipend support for each graduate student accepted into the doctoral program until they graduate, either through teaching assistant (TA) or graduate student research (GSR) appointments. Currently grad division guarantees TA appointments for a student's first two years in the program and additional appointments later in the degree depending on availability.

For Fall 2012, 22 TAs in the school of Natural sciences were students from the physics graduate program, 17 of which taught physics courses. A similar number are predicted for the following Spring. Physics students can also serve as TAs for math courses (5 appointed in Fall 2012) and this provides an additional source of appointments as the program grows.

Table 12: Physics Student Support Mechanisms

Physics student support mechanism	Total semesters of support (includes Fall, Spring and Summer) 2011-2012
Graduate Student Researcher (GSR)	10
Teaching Assistant (TA)	18
Fellowship	0
GSR/TA combination	5
TA/Fellowship combination	1
Self supported	3

There are several additional fellowship opportunities that students may take advantage of within the physics group and the university. Beginning 2013, the physics graduate group will be able to take advantage of return-to-aid funds to provide 4 full year fellowships each year and 12 summer fellowships. We hope these opportunities to grow as the group expands.

In addition to mechanisms for funding TAs, UC Merced Graduate Division sponsors competitive fellowships for PhD students to fully fund their studies. Such fellowships are desirable as they allow students to focus full time on research activities. Below are listed a number of specific competitive fellowships that are also available to physics students.

A. Chancellor's Graduate Fellowships (CGF) are intended to support entering Ph.D. students with distinguished academic records. The first round of awards for the 2012-13 academic year will be given to students who have applied and completed their applications file during our early admissions cycle. The award is comprised of central fellowship support of \$4k during the fellow's 1st through 4th years of study and is contingent upon funding from the Chancellor and student's academic progress and continued eligibility.

B. The Eugene Cota-Robles (ECR) Fellowship is intended to release recipients from employment or loan obligations that might delay progress in graduate study and to place students interested in careers in academic teaching and research on a fast-track towards achieving their doctoral degree, thereby increasing the number of qualified candidates for faculty positions within the University of California. The award is comprised of central fellowship support during the fellows' 1st year of study and renewable for one year, contingent upon funding from UCOP, and the student's academic progress and continued eligibility.

C. The Faculty Mentor Program (FMP) forms an important link in the continuum of support for academically promising graduate students. This award assists recipients in acquiring and developing advanced research skills under faculty mentorship. It is designed to improve mentoring for UC Merced

doctoral students who are not yet at the dissertation stage, but are currently engaged in research with a faculty mentor, and is expected to increase the number of students who complete their Ph.D. degree and successfully acquire a faculty appointment. Recipients will receive a stipend of \$20,700, paid monthly over a 9-month period plus payment of University fees and Graduate Student Health Insurance, excluding nonresident tuition and campus fees. Fellows are eligible for up to \$500 (to be used within the awarded year) for travel expenses related to conference presentation.

D. The President's Dissertation Year (PDY) Fellowship is intended for Ph.D. candidates graduate students in their final year of graduate school. As part of the University of California, Merced's commitment to diversity, this program is designed to identify doctoral candidates whose research or planned career focuses on problems relating to disadvantaged segments of society, or who have been educationally or economically disadvantaged. The program provides faculty mentorship, information and advice to students as they prepare to become postdoctoral fellows or candidates for faculty positions. \$18,000 fellowship/stipend, paid over a 9-month period.

E. The UC Merced Fletcher Jones Fellowship is intended for doctorate students who have advanced to candidacy and demonstrate financial need. This award is intended to assist graduate students with the completion of their degree. It is a highly prestigious award, made available through funding from the Fletcher Jones Foundation. It will provide students with a one-year fellowship. \$20,100 fellowship to be paid over a nine-month period and includes all fees.

F. The UC Merced Miguel Velez Scholarship is a prestigious award that will provide students with an academic year-long scholarship. It is intended for Latin American graduate students who exhibit excellence in character and ability. Recipients will receive a \$10,000 fellowship to be paid in two equal installments of \$5,000 each during the Fall and Spring semesters.

Beyond special fellowships and TA positions, the physics faculty assume the responsibility for the stipend and fees of their graduate students. At this stage the faculty have proven that they can successfully compete for large-scope extramural funding in support of our research and training mission (see table 5). The best way of ensuring graduate student support is through training grants from federal and state funding agencies, such as National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) grants and efforts are underway to secure this funding. A proposal by physics faculty Winston, Hirst and Ghosh was submitted in 2012 based on a program in energy research. Other training grant opportunities from federal and state agencies will be pursued. For these proposals to be competitive, we recognize that the physics group must graduate PhD students, track their success after completion of their degrees, and also promote junior faculty and recruit additional senior faculty members to provide sufficient leadership for training programs.

SECTION 8. CHANGES IN SENATE REGULATIONS

No changes in Senate Regulations at the Divisional level or in the Academic Assembly will be required.

Appendices

APPENDIX A: CPEC Information

APPENDIX B: Physics Faculty CVs

APPENDIX C: Physics Core Course Syllabi, Teaching Plan, Curriculum Map and Assessment Plan

APPENDIX D: Letters of Support from UCM Graduate and Research Council and Physics Lead Dean

APPENDIX E: Physics Policies and Procedures, group bylaws and Program learning outcomes

APPENDIX F: Physics Short-Term Strategic Plan

APPENDIX A – CPEC INFORMATION

APPENDIX A. CPEC INFORMATION

1. **Name of Program:** Physics
2. **Campus:** Merced
3. **Degree/Certificate:** M.S., Ph.D.
4. **CIP Classification:** (to be completed by UCOP)
5. **Date to be started:** July 1, 2013
6. **If modification of existing program...:** New program
7. **Purpose (academic or professional training) and distinctive features (how does this program differ from others, if any, offered in California?):**

The proposed physics program includes professional training aspects to equip M.S. graduates with knowledge and skills necessary to enter the work force in a variety of jobs including public education, industry and consulting. The Ph.D. program emphasizes academic training directed toward careers in college and university teaching and research as well as research in national laboratories and industry.

The proposed program is fairly similar to the physics graduate programs at several other UC campuses, *e.g.* at Berkeley, Santa Barbara, and Davis. The proposed program is more focused on three current forefront areas of physics (condensed matter physics, atomic, molecular and optical physics (AMO) and soft matter/biophysics) and fosters interdisciplinary and multidisciplinary research.

8. Type(s) of students to be served:

The program will serve a broad array of students including those with backgrounds in physics, materials sciences, or mathematics.

9. If program is not in current campus academic plan, give reason for proposing program now:

A graduate program in physics is in the UC Merced academic plan.

10. If the program requires approval of a licensure board, what is the status of such approval?

No such approval is required.

11. Please list special features of the program:

All academic requirements are listed the proposal.

12. List all new courses required:

No new courses are required

13. List all other required courses:

See table in Section 5.

14. List UC campuses and other California institutions which now offer or plan to offer this program of closely related programs:

All eight of the other comprehensive UC campuses (Berkeley, Davis, Irvine, Los Angeles, Riverside, San Diego, Santa Barbara, and Santa Cruz) offer Ph.D. programs in physics, as do several private universities (e.g. Stanford, Caltech). As noted above, UC Merced's program is more focused on three current forefront areas of physics (condensed matter physics, atomic, molecular and optical physics (AMO) and soft matter/biophysics) and fosters interdisciplinary and multidisciplinary research.

15. List any related program offered by the proposing institution and explain the relationship:

There are no similar programs at UC Merced.

16. Summarize employment prospects for graduates of the proposed program. Give results of a job market survey if such has been made:

No survey has been made, but we anticipate excellent job prospects for graduates of this program. According to annual surveys of their members by the American Physical Society

the unemployment rate among all chemists (bachelors and advanced degrees combined) did not exceed 4% during any year between 1972 and 2009.

The median salary for Ph.D. chemists in 2009 was \$100,000 (\$115,000 for those in the industrial/private sectors) and the median salary for M.S. chemists was \$80,619.

While the recent economic downturn has taken its toll on physicists as well as those in other professions, we still expect the long-term prospects for those with advanced degrees in physics to be good. Note, too, that unlike those in many professions such as law and medicine, physicists rarely have to cover the costs of their graduate education out of pocket and therefore enter the workforce with little or no debt arising from their graduate studies.

17. Give an estimated enrollment for the first five years and state the basis for the estimate:

There are currently 28 students in the Physics emphasis area of the Interim Individual Graduate Program who would belong in the physics group once it is approved. Estimated enrollments for the following four years are based on assuming addition of one faculty member per year and maintaining our student faculty ratio at approx. 2.5 (AY 2015-2016).

Year	Faculty FTE	# students
2012-2013	12	29

2013-2014	13	32
2014-2015	14	35
2015-2016	15	38
2016-2017	16	41

18. Give estimates of the additional cost of the program by year for 5 years in each of the following categories:

- a. FTE faculty** – We expect to add approximately one new faculty member per year, with most appointments being made at the Assistant Professor level. In addition to salary and benefits, estimated startup costs for new physics faculty range from \$400,000 to \$1,000,000 depending on research field.
- b. Library Acquisitions** – No significant impact.
- c. Computing** – No significant impact beyond equipment and infrastructure costs included in faculty startup packages.
- d. Other facilities and equipment** – Major items of research equipment will be acquired either with extramural grant funds or as part of faculty startup packages. The equipment needed will be determined by the specific research interests of the faculty hired. Some institutional support for space renovation and staffing to partially support shared facilities may be required.

19. How and by what agencies will the program be evaluated?

The Physics graduate program will be evaluated by an external review committee of UC faculty on first a five-year and then a 7-8 year cycle. The Executive Committee will prepare a self-study for prior review by the committee in accord with UC policy. After reviewing this document, the review committee will make a site visit to meet with group faculty and students, and report its findings to the group faculty, UC Merced administration, and Academic Senate.

APPENDIX B – FACULTY CVS

Jay Edward Sharping

University of California, Merced

Physics

Office Phone: (209) 228-4049

Department Phone: (209) 228-4309

Fax: (209) 228-4053

Email: jsharping@ucmerced.edu

Website: <http://faculty.ucmerced.edu/jsharping/index.html>

Research Interests

Devising new applications for photonic and nanoscale technology in diverse fields such as metrology, communication, sensing, quantum optics and biotechnology.

Education

PhD, Northwestern University, 2003.

Major: Electrical and Computer Engineering

Dissertation Title: Fiber-based entangled photon pair generation

Advisor: Kumar, P.

MS, With Distinction, Rose-Hulman Institute of Technology, 1994.

Major: Applied Optics

Dissertation Title: A study of dichromated gelatin and the construction of holographic optical elements

Advisor: Joenathan, C.

BS, With Distinction, University of Wisconsin-Whitewater, 1992.

Major: Physics and Mathematics

Advisor: Bergsten, R.

Professional Positions

Assistant Professor, Physics, University of California, Merced (2006-2012).

Postdoctoral Researcher, Cornell University. (2004 - 2006).

in the group of Alexander L. Gaeta, School of Applied & Engineering Physics

Postdoctoral researcher, Northwestern University. (2003).

in the group of Prem Kumar, Dept. of Electrical & Computer Engineering.

Teacher, Northwestern University. (2002).

Undergraduate and graduate course: Fiber-Optic Communications

Teaching Assistant, Northwestern University. (1997 - 2001).

Eng. Electromagnetics I & II, Optical Comm. Systems

Wireless & mobile computing specialist, Accenture. (1994 - 1997).

Wireless and Mobile Computing Technology Consultant.

Teaching Assistant, Rose-Hulman Institute of Technology. (1992 - 1993).

Introductory Physics

Research Laboratory Assistant, Argonne National Laboratory. (1990 - 1991).

In the group of Kenneth E. Gray

Tutor, University of Wisconsin - Whitewater. (1990 - 1991).

Mathematics and Physics

Research Laboratory Assistant, Battelle Pacific Northwest Laboratory. (1989).

In the group of Donald R. Baer

Professional Memberships

American Physical Society. (October 2006 - Present).

IEEE. (2003 - Present).

Member and Education Services Committee member, Optical Society of America. (1997 - Present).

Awards and Honors

- Young Investigator Award, Air Force Office of Science and Technology (AFOSR). (November 2008 - May 2012).
Award and grant to study fiber optical parametric oscillators and their applications in biophotonics.
- Young Faculty Award, Defense Advanced Research Projects Agency (DARPA). (March 2008 - November 2010).
Award and grant to study quantum frequency translation using optical fibers.
- Best Dissertation Award, ECE Department. (2003).
- Cabell Terminal Year Fellowship, Northwestern University. (2001).
- New Student Focus Award, OSA. (2001).
- MURI Fellowship Support, Army Research Office. (2000).
for Ph.D. studies in quantum optics
- Best Teaching Assistant, ECE Department. (1999).

RESEARCH

Intellectual Contributions

Book Sections

- Sharping, J. E.**, Kumar, P. (2004). Nonlinear optics in photonic crystal fibers. Academic Press. Publisher - Academic Press. (Current Status: Published; Date Published - 2004).

Conference/Workshop/Symposium Proceedings

- Pinon, T. M., **Hirst, L. S.**, **Sharping, J. E.** (2012). Optical Trapping and Stretching of Lipid Vesicles. In *OSA Technical Digest. CLEO: Applications and Technology*, (pp. paper: AT1M.4). (Current Status: Published; Date Published - May 2012, Date Submitted - December 2011). Principal investigator. [Full text of this item is available](#)
- Gu, C., **Ilan, B.**, **Sharping, J. E.** (2012). Spectral Mirror Imaging in Ultrafast Optical Parametric Processes. In *OSA Technical Digest. Quantum Electronics and Laser Science Conference (QELS)*, (pp. Nonlinear Optical Processes (QF2G.8)). (Current Status: Published; Date Published - May 2012, Date Submitted - December 2011). Principal investigator. [Full text of this item is available](#)
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- Sharping, J. E.**, Zhang, W. Q., Afshar V., S. (2010). Modeling of Ultrafast Fiber Optical Parametric Oscillators. In *OSA Technical Digest (CD). Frontiers in Optics (FiO) 2010*, (pp. FTuJ5). (Current Status: Published; Date Published - October 2010). Lead author and principal investigator. [Full text of this item is available](#)

- Gu, C., **Sharping, J. E.**, Wei, H., Tong, W. (2010). Fiber Length Optimization in a Dispersion Compensated Fiber Optical Parametric Oscillator. In *OSA Technical Digest. Conference on Lasers and Electro-Optics*, (pp. CtuM6). (Current Status: Published; Date Published - May 2010). Principal investigator. [Full text of this item is available](#)
- Gu, C., **Sharping, J. E.**, Wei, H., Tong, W. (2010). Chirped Sub-50 fs Pulse Generation: Optimization of Fiber Length for Ultrafast Fiber Optical Parametric Oscillators. In *OSA Technical Digest. Optical Fiber Communication Conference*, (pp. OTuJ4). (Current Status: Published; Date Published - March 2010). Principal investigator. [Full text of this item is available](#)
- Zhang, W. Q., **Sharping, J. E.**, White, R. T., Monro, T. M., Afshar V, S. (2009). Towards Microstructured-Fibre-Based Optical Parametric Oscillators for Ultra-Short-Pulse Sources in the Near-Infrared. In *Proceedings of the Australian Conference on Optical Fibre Technology, (ACOFT), Adelaide, Australia. Australian Conference on Optical Fibre Technology, (ACOFT), Adelaide, Australia*, (pp. 501-502). (Current Status: Published; Date Published - November 2009). Author. [Full text of this item is available](#)
- Sharping, J. E.**, Goulart-Pailo, C., Gu, C. (2009). Pulsed Fiber-Optical Parametric Oscillators in the Near Infrared. In *OSA Technical Digest. Nonlinear Optics*, (pp. NThA4). (Current Status: Published; Date Published - July 2009). Lead author and Principal Investigator. [Full text of this item is available](#)
- Zhong, Z., Gabor, N. M., **Sharping, J. E.**, Gaeta, A. L., McEuen, P. L. (2009). Terahertz Electrical Measurement of Single-Walled Carbon Nanotube Transistors. In *OSA Technical Digest (CD). Conference on Lasers and Electro-Optics (CLEO) 2009*, (pp. CMT-1). (Current Status: Published; Date Published - May 31, 2009). Technical contributor. [Full text of this item is available](#)
- Goulart-Pailo, C., Gu, C., **Sharping, J. E.** (2009). Full Characterization of Femtosecond Pulses at 1225-1350 nm Produced by a High Power Fiber Optical Parametric Oscillator. In *OSA Technical Digest (CD). Conference on Lasers and Electro-Optics (CLEO) 2009*, (pp. CFS1). (Current Status: Published; Date Published - May 2009). [Full text of this item is available](#)
- Sharping, J. E.** (2008). Slow Light: what we have learned and where are we going. In *Proceedings of the Australian Conference on Optical Fibre Technology, (ACOFT). Australian Conference on Optical Fibre Technology, (ACOFT)*, (pp. CTu-1). (Current Status: Published; Date Published - July 2008). Lead Author, Principal Investigator. [Full text of this item is available](#)
- Gu, C., **Ilan, B.**, **Sharping, J. E.** (2008). Parabolic Pulse Generation in Gain-Guided Optical Fibers with Nonlinearity. In *LEOS 2008 - 21st Annual Meeting of the IEEE Lasers and Electro-Optics Society (LEOS 2008)876-7 2008. LEOS 2008 - 21st Annual Meeting of the IEEE Lasers and Electro-Optics Society (LEOS 2008)876-7 2008*, (pp. 876-877). (Current Status: Published; Date Published - June 2008). Principal Investigator. [Full text of this item is available](#)
- Sanborn, J. R., Jasinski, J., **Sharping, J. E.** (2008). Tapered microstructure fibers for fiber optical parametric oscillators. In *OSA Technical Digest. Conference on Laser and Electro-Optics*, (pp. CTuL7). (Current Status: Published; Date Published - May 2008). Principal investigator. [Full text of this item is available](#)
- Sharping, J. E.**, Sanborn, J. R. (2008). Femtosecond fiber optical parametric oscillators. In *Proceedings of the IEEE/LEOS Winter Topical Meeting. IEEE/LEOS Winter Topical Meeting*, (pp. TuB3.2). (Current Status: Published; Date Published - January 2008). Lead Author. [Full text of this item is available](#)
- Sharping, J. E.**, Sanborn, J. R., Foster, M. A., Broaddus, D., Gaeta, A. L., Lasri, J., Lyngnes, O., Vogel, K. (2007). Microstructure-fiber-based ultrafast optical parametric oscillators. In

OSA Technical Digest. Frontiers in Optics, (pp. FThJ3). (Current Status: Published; Date Published - September 2007). Lead author. [Full text of this item is available](#)

- Agha, I. H., Okawachi, Y., Foster, M. A., **Sharping, J. E.**, Gaeta, A. L. (2007). Dispersion-Compensation in High-Q Silica Microspheres for Parametric Oscillation. In *OSA Technical Digest (CD). Nonlinear Photonics (NP) 2007*, (pp. NTuC1). (Current Status: Published; Date Published - September 2, 2007). Contributing Author. [Full text of this item is available](#)
- Okawachi, Y., **Sharping, J. E.**, Xu, C., Gaeta, A. L. (2007). Large tunable optical delays via self-phase modulation and dispersion. In *OSA Technical Digest Series (CD). Conference on Lasers and Electro-Optics (CLEO)*, (pp. CThAA4). (Current Status: Published; Date Published - May 2007). Author. [Full text of this item is available](#)
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- Ghosh, S., **Sharping, J. E.**, Ouzounov, D. G., Gaeta, A. L. (2005). Coherent resonant

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- Zhong, Z., Gabor, N. M., **Sharping, J. E.**, Gaeta, A. L., McEuen, P. L. (2008). Terahertz time-domain measurement of ballistic electron resonance in a single-walled carbon nanotube. *Nature Nanotechnology*, 3, 201-205. Publisher - Nature Nanotechnology. (Current Status: Published; Date Published - April 2008). Technical contributor. [Full text of this item is available](#)
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- Sharping, J. E.** (2007). Rubidium on a chip. *Nature Photonics*, 1, 315-316. Publisher - Nature Publishing Group. (Current Status: Published; Date Published - June 2007). Lead Author, Principal Investigator. [Full text of this item is available](#)
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Fiorentino, M., **Sharping, J. E.**, Kumar, P., Porzio, A. (2002). Amplitude squeezing in a Mach-Zehnder interferometer: numerical analysis of experiments with microstructure fiber. *Optics Letters*, 10(2), 128-138. Publisher - Optical Society of America. ISSN: 1094-4087. (Current Status: Published; Date Published - 2002).

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Kim et al. (1993). Effect of substrate-twin-induced microstructure on transport properties of epitaxial Tl₂Ba₂CaCu₂O_x films in a magnetic field. *IEEE Transactions on Applied Superconductivity*, 3(1), 1208 - 1210. Publisher - IEEE Transactions on Applied Superconductivity. ISSN: 1051-8223. (Current Status: Published; Date Published - 1993).

Published Abstracts

Kiani, L. S., Munasinghe, T., Zhang, W.-Q., Vahid, S. A., **Sharping, J. E.** (2012). Linear and nonlinear-optical properties in soft glass optical fibers for device applications [Abstract]. *Proceedings of the APS March meeting*. Publisher - Proceedings of the APS March meeting. (Current Status: Published; Date Published - February 2012, Date Submitted - November 2011). Principal investigator.

Presentations Given

- Pinon, T. M. (Presenter & Author), Hirst, L. S. (Author), Sharping, J. E. (Author), CLEO: Applications and Technology (CLEO: A and T) 2012 paper, "Optical Trapping and Stretching of Lipid Vesicles," Optical Society of America, San Jose, CA. (May 2012).
- Gu, C. (Presenter & Author), Ilan, B. (Author), Sharping, J. E. (Author), "Quantum Electronics and Laser Science Conference (QELS) 2012, "Spectral Mirror Imaging in Ultrafast Optical Parametric Processes," Optical Society of America, San Jose, CA. (May 2012).
- Sharping, J. E., Sacramento State Physics Colloquium, "Fiber-Based Dual-Beam Optical Trapping System for Studying Lipid Vesicle Mechanics," Physics Department, Sacramento State University. (February 2012).
- Sharping, J. E., University of California Biophotonics Industry Forum, "Biophotonics at the University of California - Merced," UC Biophotonics Industry Alliance, San Francisco, CA. (January 2012).
- Sharping, J. E., SHE academic excellence night, "Thoughts on a most excellent adventure," Society of Hispanic Engineers, UC Merced. (December 2011).
- Sharping, J. E., The UCM English Language Institute, "Process oriented manuscript writing," University of California Merced, UC Merced. Workshop for graduate students. (October 2011).
- Sharping, J. E., NSF Center for Biophotonic Science and Technology (CBST) retreat, "What's new at UC Merced?," National Science Foundation, Squaw Valley, CA. Summary of biophotonics research at UC Merced. (July 2011).
- Pinon, T. M. (Presenter), Hirst, L. S. (Author), Sharping, J. E. (Author), NSF Center for Biophotonics Science and Technology (CBST) retreat, "Dual-Beam Optical Fiber Trapping System for Studying Lipid Vesicle Mechanics," National Science Foundation, Squaw valley CA. Poster session. (July 2011).
- Sharping, J. E., HP Laboratories, "Ultrashort Pulsed Light Sources Based On Nonlinear Fiber Optics," Palo Alto, CA. (June 2011).
- Sharping, J. E., NcalOSA Northern California section of the OSA, "UltrashortPulsed Light Sources Based On Parametric Processes in Optical Fibers," Stanford, CA. (June 2011).
- Sharping, J. E., Conference on Lasers and Electro Optics, "Analysis of ultrashort pulsed FOPOs," Optical Society of America, Baltimore, MD. (May 2011).
- Sharping, J. E. (Author), Pinon, T. M. (Presenter), Optical Trapping Applications conference, "Fiber-Based Dual-Beam Optical Trapping System for Studying Lipid Vesicle Mechanics," OSA, Monterey, CA. (April 2011).
- Sharping, J. E., Physics colloquium, "Ultrashort Pulsed Light Sources Based on Nonlinear Optical Fibers," University of California, Davis, Davis, CA. (April 2011).
- Sharping, J. E. (Author), Pinon, T. M. (Presenter), March Meeting of the American Physical Society, "Studies of lipid vesicle mechanics using an optical fiber dual-beam trap.," APS, Dallas, TX. (March 2011).
- Sharping, J. E. (Author), Gu, C. (Presenter), Optical Fiber Communication Conference, "XPM Induced Spectral Effects in High Efficiency Picosecond Fiber Optical Parametric Oscillators," OSA, Los Angeles, CA. (March 2011).
- Sharping, J. E., Monday seminar series, "Ultrashort Pulsed Light Sources Based On Nonlinear Fiber Optics," UC Merced, Merced, CA. (March 2011).
- Sharping, J. E., Mechanical Engineering Colloquium, "Ultrashort Pulsed Light Sources Vased on Parametric Processes in Optical Fibers," University of California, Riverside, Riverside CA. (December 2010).
- Sharping, J. E., Frontiers in Optics, "Fiber OPO for Multimodal CARS Imaging," OSA, Rochester, NY. (October 2010).
- Sharping, J. E., Frontiers in Optics, "Modeling of Ultrafast Fiber Optical Parametric Oscillators," OSA, Rochester, NY. (October 2010).
- Sharping, J. E., Purdue University, "Fiber optical parametric oscillators," West Lafayette Indiana. Presentation to instrumentation group of Ji-Xin Cheng. (July 2010).
- Sharping, J. E. (Author), Pinon, T. M. (Presenter & Author), Hirst, L. S. (Author), UC Bioengineering Conference, "Dual beam optical fiber trapping system for studying lipid vesicle dynamics," University of California, Davis, Davis, CA. (June 2010).
- Sharping, J. E. (Presenter & Author), Gu, C. (Author), Wei, H. (Author), Tong, W. (Author), Conference on Lasers and Electro-Optics (CLEO), "Fiber Length Optimization in a Dispersion Compensated Fiber Optical Parametric Oscillator," Optical Society of America, Panel: Nonlinear Fiber Sources, San Jose, CA. (May 2010).

- Sharping, J. E., Relay for Life, "Optics posters for display," American Cancer Society, Merced, CA. We prepared 4 sets of posters highlighting UC Merced research activities. (April 2010).
- Sharping, J. E., Challenger Lecture Series, "What do sunken ships and laser physics have in common?," Challenger Learning Center, Atwater, CA. (April 2010).
- Sharping, J. E. (Author), Gu, C. (Presenter), Wei, H. (Author), Tong, W. (Author), Optical Fiber Communication Conference (OFC), "Chirped Sub-50 fs Pulse Generation: Optimization of Fiber Length for Ultrafast Fiber Optical Parametric Oscillators," Optical Society of America, Panel: Ultrashort and High Power Lasers, San Diego, California. (March 2010).
- Sharping, J. E., Physics Colloquium, "Ultrashort Pulsed Light Sources Based On Nonlinear Fiber Optics," San Francisco State University, San Francisco, CA. (March 2010).
- Sharping, J. E. (Presenter & Author), Goulart-Pailo, C. (Author), Kiani, L. (Author), Sanborn, J. R. (Author), Zhai, Y.-H. (Author), Gu, C. (Author), Australian Conference on Optical Fiber Technology (ACOFT), "Classical and Quantum Light Sources Based On Parametric Processes in Optical Fibres," Australian Optical Society and University of Adelaide, Adelaide Australia. (November 2009 - December 2009).
- Sharping, J. E. (Author), Zhang, W. Q. (Presenter & Author), White, R. T. (Author), Monro, T. M. (Author), Afshar V., S. (Author), Australian Conference on Optical Fibre Technology, "Towards Microstructured-Fibre-Based Optical Parametric Oscillators for Ultra-Short-Pulse Sources in the Near-Infrared," Australian Optical Society and University of Adelaide, Adelaide Australia. (November 2009 - December 2009).
- Sharping, J. E. (Presenter & Author), Pailo, C. (Author), Gu, C. (Author), Nonlinear Optics: Materials, Fundamentals and Applications (NLO), "Pulsed Fiber-Optical Parametric Oscillators in the Near Infrared," Optical Society of America, Panel: Parametric Processes and Oscillators, Honolulu, Hawaii. (July 2009).
- Sharping, J. E. (Author), Pinon, T. M. (Presenter & Author), UC Bioengineering Conference, "Dual beam optical fiber trapping platform for biophotonics applications," University of California, Merced, Merced, CA. (June 2009).
- Sharping, J. E., Conference on Lasers and Electro Optics, "Full characterization of femtosecond pulses at 1225-1350 nm produced by a high power fiber optical parametric oscillator," OSA, Baltimore, MD. (May 2009).
- Sharping, J. E. (Author), Gu, C. (Presenter), Laser and Electro Optics Society (LEOS), "Parabolic Pulse Generation in Gain-Guided Optical Fibers with Nonlinearity," IEEE, Acapulco Mexico. (November 2008).
- Sharping, J. E., Center For Biophotonic Science and Technology, "Fiber Optical Parametric oscillators for Biophotonics," Applied Photonics Research Group, Sacramento CA. (October 2008).
- Sharping, J. E., Colloquium, "Fiber optical parametric oscillators for biophotonics," Center for Biophotonics Science and Technology (CBST), Sacramento, CA. (October 2008).
- Sharping, J. E., Australian Conference on Optical Fibre Technology, "Slow light: what we have learned and where are we going," Sydney Australia. (July 2008).
- Sharping, J. E. (Author), Sanborn, J. R. (Presenter), Conference on Lasers and Electro Optics, "Tapered Microstructure Fibers for Fiber Optical Parametric Oscillators," OSA, San Jose, CA. (May 2008).
- Sharping, J. E., Biophotonics Colloquium, "Fiber Optical Parametric oscillators for Biophotonics," Beckman Research Center, UC Irvine, Irvine, CA. (February 2008).
- Sharping, J. E., IEEE/LEOS Winter Topical Meeting 2008, "Femtosecond fiber optical parametric oscillators," IEEE, Sorento, Italy. (January 2008).
- Sharping, J. E., Science day at Ceres High School, "Physics and biotechnology," Ceres, CA. (January 2008).
- Sharping, J. E., Technology and Society Symposium, "How Today's Fundamental Physics enables tomorrows Technology," UC Merced, Merced, CA. (November 2007).
- Sharping, J. E., Frontiers in Optics, "Microstructure-Fiber-Based Ultrafast Optical Parametric Oscillators," OSA, San Jose, CA. (September 2007).
- Sharping, J. E., Physics Colloquium, "Fiber optical parametric oscillators: a new avenue into the wavelength-tunable ultrafast domain," University of Washington, Seattle WA. (May 2007).
- Sharping, J. E., Challenger Lecture Series, "Pushing the limits of glass... fiber-based sources and devices," Challenger Learning Center, Atwater, CA. (May 2007).
- Sharping, J. E., Physics Colloquium, "Pushing the Limits of Glass fiber based Sources and Devices," Sacramento State University, Sacramento CA. (February 2007).

- Sharping, J. E., APS Division of Laser Sciences New Laser Scientist Meeting, "Recent advancements in fiber optical parametric oscillators and their applications," American Physical Society, Rochester, NY. (October 2006).
- Sharping, J. E., Laser Science, "Fiber-Based Optical Parametric Oscillator with 50-mW Average Output Power and 200 nm of Wavelength Tunability," APS, Rochester, NY. (October 2006).
- Sharping, J. E., Ghosh, S., Hensley, C. J., Gaeta, A. L., Annual Meeting of the Lasers and Electro-Optics Society of IEEE (LEOS'05), "Novel nonlinear processes in photonic bandgap fibers," Sydney, Australia. (2005).
- Sharping, J. E., Okawachi, Y., van Howe, J., Xu, C., Gaeta, A. L., Conference on Lasers and Electro-Optics (CLEO'05), "All-optical, continuously-tunable, nanosecond pulse delay using wavelength conversion and fiber dispersion," Baltimore, MD. (2005).
- Ghosh, G., Sharping, J. E., Ouzounov, D. G., Gaeta, A. L., Conference on Lasers and Electro-Optics (CLEO'05), "Coherent resonant interactions with molecules in photonic band-gap fibers," Baltimore, MD. (2005).
- Okawachi, Y., Sharping, J. E., Gaeta, A. L., Bigelow, M. S., Schweinsberg, A., Boyd, R. W., Zhu, Z., Gauthier, D. J., Conference on Lasers and Electro-Optics (CLEO'05), "Tunable all-optical delays via Brillouin slow light in an optical fiber," Baltimore, MD. (2005).
- Sharping, J. E., Ghosh, S., Okawachi, Y., Gaeta, A. L., Bigelow, M. S., Schweinsberg, A. S., Boyd, R. W., Zhu, Z., Gauthier, D. J., Optics and Photonics meeting of the International Society of Optical Engineering (SPIE'05), "Slow light techniques in optical fibers," San Diego, CA. (2005).
- Li, X., Voss, P. L., Sharping, J. E., Chen, J., Kumar, P., Annual Meeting of the Optical Society of America (OSA'03), "Generation and distribution of quantum entanglement in the telecom band with standard optical fiber," Tucson, AZ. (2003).
- Sharping, J. E., Kumar, P., Arnold, M. S., Hersam, M. C., Stupp, S. I., Annual Meeting of the Optical Society of America (OSA'03), "Stimulated emission in single-walled carbon nanotubes," Tucson, AZ. Poster. (2003).
- Sharping, J. E., Kumar, P., Arnold, M. S., Hersam, M. C., Stupp, S. I., Annual Meeting of the Optical Society of America (OSA'03), "Stimulated emission in single-walled carbon nanotubes," Tucson, AZ. Poster. (2003).
- Li, X., Voss, P. L., Sharping, J. E., Kumar, P., Conference on Quantum Electronics and Laser Science (QELS'03), "Violation of Bell's inequality near 1550 nm using an all-fiber source of polarization-entangled photons," Baltimore, MD. (2003).
- Fiorentino, M. (Presenter & Author), Voss, P. L. (Author), Li, X., Sharping, J. E. (Author), Barbosa, G. A. (Author), Kumar, P. (Author), Conference on Lasers and Electro-Optics (CLEO'02), "All-fiber photon-pair source for quantum communications," Long Beach, CA. (2002).
- Sharping, J. E. (Presenter & Author), Fiorentino, M. (Author), Kumar, P. (Author), Windeler, R. S. (Author), Conference on Lasers and Electro-Optics (CLEO'02), "Optical-parametric oscillator based on four-wave mixing in microstructure fiber," Long Beach, CA. (2002).
- Lasri, J. (Presenter & Author), Tang, R. (Author), Sharping, J. E. (Author), Kumar, P. (Author), Devgan, P. (Author), Conference on Lasers and Electro-Optics (CLEO'03), "A 10-GHZ rate microstructure-fiber based widely tunable optical-parametric oscillator in the telecom band," Baltimore, MD. Poster Presentation. (2002).
- Li, X. (Presenter & Author), Voss, P. L. (Author), Sharping, J. E. (Author), Fiorentino, M. (Author), Kumar, P. (Author), Conference on Non-linear Optics (NLO'02), "An all-fiber source of polarization-entangled photon pairs in the 1550 nm telecom band," Honolulu, HI. (2002).
- Kumar, P. (Presenter & Author), Li, X. (Author), Fiorentino, M. (Author), Voss, P. L. (Author), Sharping, J. E. (Author), Barbosa, G. A. (Author), Sixth International Conference on Quantum Communication, Measurement, and Computing (QCM'02), "Fiber-optic sources of quantum entanglement," Cambridge, MA. (2002).
- Sharping, J. E. (Presenter & Author), Fiorentino, M. (Author), Kumar, P. (Author), Windeler, R. S. (Author), Annual Meeting of the Lasers and Electro-Optics Society (LEOS'01), "Experimental nonlinear optics in microstructure fiber," San Diego, CA. (2001).
- Sharping, J. E. (Presenter & Author), Coker, A. (Author), Fiorentino, M. (Author), Kumar, P. (Author), Windeler, R. S. (Author), Annual Meeting of the Optical Society of America (OSA'01), "Four-wave mixing in microstructure fiber," Long Beach, CA. (2001).
- Fiorentino, M. (Author), Voss, P. L. (Author), Sharping, J. E. (Presenter & Author), Kumar, P. (Author), Annual Meeting of the Optical Society of America (OSA'01), "Fourth-order quantum interference at 1550 nm," Long Beach, CA. (2001).
- Sharping, J. E. (Presenter & Author), Fiorentino, M. (Author), Kumar, P. (Author), Windeler, R. S. (Author), Annual Meeting of the Optical Society of America (OSA'01), "Nonlinear fiber optics in microstructure fiber," Long Beach, CA. (2001).

Sharping, J. E. (Presenter & Author), Fiorentino, M. (Author), Kumar, P. (Author), Annual Meeting of the Optical Society of America (OSA'00), "Observation of twin-beam-type quantum correlation in optical fiber," Providence, RI. (2000).

Contracts, Grants and Sponsored Research

Grant

- Sharping, Jay Edward (Co-Principal Investigator), Monro, Tanya (Principal Investigator), Afshar V., Shahraam (Co-Principal Investigator), "Nonlinear photonic nanowires; new fundamental theory and applications for new mid-infrared laser sources," Australian research council (ARC). (February 2011 - July 2012).
- Sharping, Jay Edward (Principal Investigator), "COMPACT FIBER-PARAMETRIC DEVICES FOR BIOPHOTONICS APPLICATIONS," Air Force, Office of Scientific Research, \$304,514.00. (July 2009 - May 2012).
- Sharping, Jay Edward (Principal Investigator), "Optical correlation measurements depicting the transition from classical to quantum behavior," Graduate Research Council. (March 2012 - April 2012).
- Sharping, Jay Edward (Principal Investigator), "Investigation of Brillouin gain in soft-glass Hex SC microstructured optical fibers," HP Innovation award. (January 2012 - February 2012).
- Sharping, Jay Edward (Principal Investigator), "CAREER: Quantum correlations and frequency translation in optical fibers," NSF - National Science Foundation. (July 2011 - January 2012).
- Sharping, Jay Edward (Principal Investigator), Cheng, Ji-Xin (Co-Principal Investigator), "Collaborative Research: IDBR: Compact and affordable CARS microscopy," NSF - National Science Foundation, \$387,122.00. (July 2011 - January 2012).
- Sharping, Jay Edward (Principal Investigator), "Optical stretching and manipulation of lipid vesicles for stress-induced functionality," DOE - Dept of Energy. (September 2011 - November 2011).
- Sharping, Jay Edward (Principal Investigator), Hirst, Linda S (Co-Principal Investigator), "Microfluidic, fiber-integrated optical trapping," UC Discovery Grant, \$57,044.00. (April 2011 - July 2011).
- Sharping, Jay Edward (Principal Investigator), Afshar V., Shahraam (Co-Principal Investigator), "EPMT: Novel glass microstructured fibers for wideband optical parametric oscillators," NSF - National Science Foundation, \$357,763.00. (February 2011 - July 2011).
- Sharping, Jay Edward (Principal Investigator), Hirst, Linda S (Co-Principal Investigator), "Mechanical and growth dynamics of lipid vesicles in fiber-optical traps," Graduate Research Council, \$20,000.00. (March 2011).
- Sharping, Jay Edward (Principal Investigator), "Wideband Quantum Frequency Conversion in Optical Fibers: Enabling Transparent Quantum Information Processing," DARPA, \$150,678.00. (May 2008 - December 2010).
- Sharping, Jay Edward (Co-Principal Investigator), Hirst, Linda S (Co-Principal Investigator), Chin, Wei-Chun (Co-Principal Investigator), "Assessing toxic nano-particle intake with a microfluidic optical trap," Defense threat reduction agency (DTRA), \$711,420.00. (October 2010).
- Sharping, Jay Edward (Principal Investigator), Cheng, Ji-Xing (Collaborator), "IDBR Compact and affordable CARS microscopy," NSF - National Science Foundation, \$326,351.00. (August 2010).
- Sharping, Jay Edward (Co-Principal Investigator), Cheng, Ji-Xin (Principal Investigator), "Stimulated Raman Scattering Microscopy," NIH - National Institutes of Health, \$377,001.00. (June 2010).
- Sharping, Jay Edward (Co-Principal Investigator), Ghosh, Sayantani (Principal Investigator), "MRI: Acquisition of a Composite Femtosecond Lasing System for Broadband Non-linear Static and Dynamic Optical Analysis of Organic and Semiconducting Systems," NSF - National Science Foundation, \$656,473.00. (August 2008 - May 2010).
- Sharping, Jay Edward (Co-Principal Investigator), Hirst, Linda S (Principal Investigator), "Stretching the cell Membrane: A optical trapping microfluidic platform to probe cell membrane mechanics," Graduate research council, \$10,000.00. (March 2010).
- Sharping, Jay Edward (Principal Investigator), Afshar V., Shahraam (Co-Principal Investigator), "EPDT: Novel glass microstructured fibers for wideband optical parametric oscillators," NSF - National Science Foundation, \$398,821.00. (February 2010).
- Sharping, Jay Edward (Principal Investigator), "CAREER: Fiber based quantum frequency translation," NSF - National Science Foundation, \$400,000.00. (July 2009).
- Sharping, Jay Edward (Collaborator), Lu, Jian (Principal Investigator), "SBIR: All fiber-based high power Mid-IR precision frequency combs," NSF - National Science Foundation, \$30,000.00. (August 2008 - July 2009).

- Sharping, Jay Edward (Principal Investigator), "Fiber-optical trapping and microfluidics: a platform for single cell biophotonics," Beckman Research Institute, \$300,000.00. (October 2008).
- Sharping, Jay Edward (Principal Investigator), "Optical fiber array devices for particle trapping and manipulation," Graduate Research Council, \$4,500.00. (June 2007 - May 2008).
- Sharping, Jay Edward, "Advanced tunable light sources for biochemical applications," NSF - National Science Foundation, \$438,772.00. (March 2008).
- Sharping, Jay Edward (Principal Investigator), "Recipient proposal for multicore photonic crystal fiber applications to water quality sensing and fiber optical parametric oscillators," Optoelectronics Industry Development Association (OIDA) PTAP program, \$35,000.00. (February 2008 - March 2008).
- Sharping, Jay Edward (Principal Investigator), "Integrated microfluidic and optical fiber array devices for cell trapping and manipulation," University of California Biotechnology Research & Education Program. (October 2007).
- Sharping, Jay Edward (Principal Investigator), "Fiber optical parametric oscillators: compact and portable ultrafast light sources for biophotonics," NSF - National Science Foundation, \$323,436.00. (August 2007).
- Sharping, Jay Edward (Principal Investigator), "Fiber-optical trapping and microfluidics: a platform for single cell biophotonics," Beckman Research Institute. (August 2007).
- Sharping, Jay Edward, "CAREER: Optical Pulse Formation and Propagation in Photonic Structures," NSF - National Science Foundation, \$400,033.00. (July 2007).
- Sharping, Jay Edward, "YIP: Ultrafast compact fiber optical parametric oscillators," Air Force, Office of Scientific Research, \$299,462.00. (July 2007).
- Sharping, Jay Edward (Collaborator), Vogel, Kurt (Principal Investigator), "Ultrafast tunable light sources," NIST: Advanced technology program, \$390,864.00. (May 2007).
- Sharping, Jay Edward (Principal Investigator), Chiao, Raymond Yu (Co-Principal Investigator), "Trapping, manipulating, and characterizing Millikan oil drops," UC Merced School of Natural Sciences, \$1,000.00. (October 2006 - May 2007).
- Sharping, Jay Edward (Co-Principal Investigator), Khine, Michelle (Principal Investigator), "MRI: Development of a Single-Cell Rapid Interrogation Platform (SCRIP)," NSF - National Science Foundation, \$371,063.00. (January 2007).
- Sharping, Jay Edward (Principal Investigator), "Recipient proposal for optoelectronic devices for fiber optical parametric oscillators," Optoelectronics Industry Development Association (OIDA) PTAP program, \$25,000.00. (September 2006).

Multiple Campus Award

- Sharping, Jay Edward (Collaborator), Matthews, Dennis (Principal Investigator), "University of California Biophotonics Industry Forum," University of California OP, \$2,000.00. (June 2011 - May 2012).
- Sharping, Jay Edward (Co-Principal Investigator), Lipson, Michal (Principal Investigator), "Cornell Center for Ultralow Power Communications," NSF - National Science Foundation. (October 2009).
- Sharping, Jay Edward (Co-Principal Investigator), Lipson, Michal (Principal Investigator), "Cornell Engineering Education Institute," NSF - National Science Foundation. (August 2009).
- Sharping, Jay Edward (Co-Principal Investigator), Kumar, Prem (Principal Investigator), "Terabit per second optical parametric amplifier serializer/deserializer," Defense Advanced Research Projects Agency (DARPA), \$9,586,843.00. (July 2008).

Special Non-Cash Agreement

- Sharping, Jay Edward (Co-Principal Investigator), Monro, Tanya (Principal Investigator), "Ultrafast, near IR laser sources using fibre-based optical parametric oscillators," Australian research council (ARC). (January 2011 - December 2014).

Subcontract

- Sharping, Jay Edward (Co-Principal Investigator), Lu, Jian (Principal Investigator), "Subcontract to all fiber-based high power Mid-IR precision frequency combs," Air Force, Office of Scientific Research, \$30,000.00. (July 2009 - March 2010).
- Sharping, Jay Edward (Collaborator), Lu, Jian (Principal Investigator), "SBIR: Fiber based quantum limited optical frequency conversion," NSF - National Science Foundation, \$30,000.00. (June 2007).

Intellectual Property

- Sharping, J. E., Pinon, T. M., Castelli, A., Hirst, L. S., Patent, "Simple and inexpensive optical fiber based light force particle trapping and microfluidic system", Disclosure to UC Merced Technology Transfer. (submit: May 2012).
- Sharping, J. E., Pinon, T. M., Patent, "OPTICAL-FIBER BASED LIGHT FORCE PARTICLE TRAPPING AND MICROFLUIDIC APPARATUS, SYSTEM AND METHOD", US Provisional Pat: 61/472,366; UC Ref: 060933-6800, Provisional, United States. (submit: February 2011, application: March 2011).
- Foster, M. A., Sharping, J. E., Gaeta, A. L., Patent, "SILICON INTEGRATED PHOTONIC OPTICAL PARAMETRIC AMPLIFIER OSCILLATOR AND WAVELENGTH CONVERTER", 3985-02-US, Regular, United States. (submit: November 2008, approve: March 2011).
- Sharping, J. E., Foster, M., Gaeta, A., Patent, "Fiber optical parametric oscillator with high power and bandwidth", 7,898,731, Regular, United States. (application: November 2008, approve: March 2011).
- Gaeta, A. L., Sharping, J. E., Xu, C., Patent, "All-optical, continuously tunable, pulse delay generator using wavelength conversion and dispersion", 7,538,935, Regular, United States. (application: March 2006, approve: May 2009).
- Kumar, P., Sharping, J. E., Patent, "Microstructure fiber optical parametric oscillator", 6,958,855, Regular, United States. (application: September 2003, approve: October 2005).
- Kumar, P., Fiorentino, M., Voss, P., Sharping, J. E., Patent, "All-fiber photon-pair source for quantum communications", 6,897,434, Regular, United States. (application: February 2003, approve: May 2005).

Professional Service

- Optical Society of America - Member and Education Services Committee, Member, Washington, DC, USA, Appointed, Pro Bono, International. (July 2008 - Present).
- Optics Communications, Journal Article Reviewer, Appointed, Pro Bono, International. (July 2011 - June 2012).
- Optics Letters, Journal Article Reviewer. (July 2011 - June 2012).
- Journal of Selected Topics on Quantum Electronics, Journal Article Reviewer, Appointed, Pro Bono, International. (July 2010 - June 2011).
- Optics Communications, Journal Article Reviewer, Appointed, Pro Bono, International. (July 2010 - June 2011).
- Optics Express, Journal Article Reviewer. (July 2010 - June 2011).
- Optics Letters, Journal Article Reviewer. (July 2010 - June 2011).
- Conference on Lasers and Electro-Optics, Organizer, Baltimore, MD, USA, Appointed, Pro Bono, International, Invited 5 distinguished speakers and filled two oral presentation sessions.. (September 2010 - May 2011).
- American Physical Society Division of Laser Science meeting program subcommittee member, Co-Organizer, USA, Appointed, Pro Bono, International. (January 2010 - October 2010).
- IEEE Photonics Technology Letters, Journal Article Reviewer. (July 2009 - June 2010).
- Optics Express, Journal Article Reviewer. (July 2009 - June 2010).
- Optics Letters, Journal Article Reviewer. (July 2009 - June 2010).
- Optics Express, Journal Article Reviewer. (July 2008 - July 2009).
- IEEE Photonics Technology Letters, Journal Article Reviewer. (July 2008 - June 2009).
- Optics Letters, Journal Article Reviewer. (July 2008 - June 2009).
- Conference on Lasers and Electro-Optics, Reviewer, Appointed, Pro Bono, International. (January 2009 - March 2009).
- Optics Express, Journal Article Reviewer. (July 2007 - July 2008).
- IEEE Photonics Technology Letters, Journal Article Reviewer. (July 2007 - June 2008).
- Optics Letters, Journal Article Reviewer. (July 2007 - June 2008).
- Conference on Lasers and Electro-Optics, Reviewer, Appointed, Pro Bono, International. (January 2008 - March 2008).
- Optics Express, Journal Article Reviewer. (July 2006 - July 2007).
- IEEE Photonics Technology Letters, Journal Article Reviewer. (July 2006 - June 2007).
- Nature Photonics, Journal Article Reviewer. (July 2006 - June 2007).

New Journal of Physics, Journal Article Reviewer. (July 2006 - June 2007).

Optical Society of America Special Publications and Activities Committee, Member, Appointed, Pro Bono, International.
(July 2006 - June 2007).

Optics Letters, Journal Article Reviewer. (July 2006 - June 2007).

Conference on Lasers and Electro-Optics, Reviewer, Appointed, Pro Bono, International. (January 2007 - March 2007).

Consulting

For Profit Organization, PolarOnyx, Inc., UC Merced. (January 2009 - March 2009).

QuickSet International, Northbrook, IL. (2003).

Accenture, Chicago, IL. (1994 - 1997).

TEACHING

Teaching Experience

University of California, Merced

Spring, 2012

BEST 292, Group Meeting. (Spring 2012)
BEST 295, Graduate Research. (Spring 2012)
PHYS 148, Modern Optics. (Spring 2012)
PHYS 196, Undergraduate Thesis. (Spring 2012)
PHYS 295, Graduate Research. (Spring 2012)

Fall, 2011

BEST 292, Group Meeting. (Fall 2011)
BEST 295, Graduate Research. (Fall 2011)
PHYS 137, Quantum Mechanics Core. (Fall 2011)
PHYS 195, Upper Division Undergraduate Research. (Fall 2011)
PHYS 295, Graduate Research. (Fall 2011)

Summer, 2011

PHYS 195, Upper Division Undergraduate Research. (Summer 2011)

Spring, 2011

BEST 292, Group Meeting. (Spring 2011)
BEST 295, Graduate Research. (Spring 2011)
PHYS 160, Modern Physics Lab. (Spring 2011)
PHYS 195, Upper Division Undergraduate Research. (Spring 2011)
PHYS 293, Physics Colloquium. (Spring 2011)
PHYS 295, Graduate Research. (Spring 2011)

Fall, 2010

BEST 292, Group Meeting. (Fall 2010)
BEST 295, Graduate Research. (Fall 2010)
PHYS 148, Modern Optics. (Fall 2010)
PHYS 195, Upper Division Undergraduate Research. (Fall 2010)
PHYS 293, Physics Colloquium. (Fall 2010)
PHYS 295, Graduate Research. (Fall 2010)

Summer, 2010

BEST 295, Graduate Research. (Summer 2010)

Spring, 2010

BEST 292, Group Meeting. (Spring 2010)
BEST 295, Graduate Research. (Spring 2010)

PHYS 160, Modern Physics Lab. (Spring 2010)
PHYS 195, Upper Div Undergrad Research. (Spring 2010)
PHYS 198, Applied Optics. (Spring 2010)
PHYS 293, Physics Colloquium. (Spring 2010)
PHYS 295, Graduate Research. (Spring 2010)
PHYS 298, Applied Optics. (Spring 2010)

Fall, 2009

BEST 292, Group Meeting. (Fall 2009)
BEST 295, Graduate Research. (Fall 2009)
PHYS 195, Upper Div Undergrad Research. (Fall 2009)
PHYS 293, Physics Colloquium. (Fall 2009)
PHYS 295, Graduate Research. (Fall 2009)

Summer, 2009

BEST 295, Optics. (Summer 2009)
BEST 299, Biophotonics. (Summer 2009)

Spring, 2009

BEST 292, Group Meeting. (Spring 2009)
BEST 295, Biophotonics. (Spring 2009)
BEST 299, Biophotonics 2. (Spring 2009)
PHYS 160, Modern Physics Lab. (Spring 2009)
PHYS 195, Upper Div Undergrad Research. (Spring 2009)
PHYS 199, Upper Div Individual Study. (Spring 2009)
PHYS 295, Graduate Research. (Spring 2009)
PHYS 95, Research Laser Physics. (Spring 2009)

Fall, 2008

BEST 292, Group Meeting. (Fall 2008)
BEST 295, Biophotonics-Optical Trapping. (Fall 2008)
BEST 299, Optics - Self Study. (Fall 2008)
PHYS 195, Undergrad Optics Project. (Fall 2008)
PHYS 295, Graduate Research. (Fall 2008)
PHYS 8, Introductory Physics I. (Fall 2008)

Spring, 2008

BEST 292, Group Meeting. (Spring 2008)
BEST 295, Graduate Research. (Spring 2008)
PHYS 105, Analytic Mechanics. (Spring 2008)
PHYS 198, Optics. (Spring 2008)
PHYS 295, Graduate Research. (Spring 2008)
PHYS 298, Optics. (Spring 2008)

Fall, 2007

PHYS 199, Upper Div Individual Study. (Fall 2007)

PHYS 295, Optical Trapping & Nonlin Opti. (Fall 2007)

PHYS 8, Introductory Physics I. (Fall 2007)

Fall, 2006

PHYS 8, Introductory Physics I. (Fall 2006)

Other

Faculty - Instructor mentor for Carrie Menke, (January 2009 - May 2009).

Supervised, consulted with and evaluated instructors for physics courses taught by instructors.

Preparation for new course "Modern Physics Laboratory", (January 2008 - May 2009).

Specified experiments and equipment for the upper division physics laboratory experience. Offered for the first time in the spring semester of 2009.

Physics 8 course improvements, (August 2008 - December 2008).

Added demonstrations of inclined plane with friction and circular motion with a remote-controlled car.

Faculty - Instructor mentor for Vesselin Gueorguiev, (August 2008 - December 2008).

Supervised, consulted with and evaluated instructors for physics courses taught by instructors.

Faculty - Instructor mentor for Carrie Menke, (August 2008 - December 2008).

Supervised, consulted with and evaluated instructors for physics courses taught by instructors.

New course offering, (January 2008 - May 2008).

Offered Physics 105, Analytic Mechanics, for the first time at UC Merced

Course improvements, (August 2006 - December 2006).

Assembled 10 new in class demonstrations for Physics 008 Introductory Physics

Doctoral Candidacy Committee

August 2011 - Present, Chai Lor, Member

August 2011 - Present, Steve Hill, Member

July 2011 - Present, Ronald Pandolfi, Chair

January 2011 - Present, Dan Hu, Member

August 2010 - Present, Leily Kiani, Advisor

December 2009 - Present, Tessa Pinon, Advisor

June 2009 - Present, Emily Reed, Member

August 2007 - Present, Chenji Gu, Advisor

February 2008 - April 2012, Marina Stavitskaya, Chair

February 2009 - March 2012, Somnath Ghosh, Chair

May 2009 - March 2010, Yashwant Verma, Advisor

August 2008 - August 2009, Luis Martinez, Co-Advisor

Doctoral Committee

April 2008 - July 2011, Hoda Mirafzal, Member

April 2007 - May 2011, Korana Burke, Chair

January 2009 - July 2010, Igor Goncharenko, Member

April 2007 - May 2010, Steve Minter, Member

May 2008, Joe T. Mok, Oversight Member Dissertation reader

Master's Thesis Committee

August 2011 - Present, Robert Campos, Member

August 2008 - August 2010, Christiane Pailo

August 2007 - December 2009, Tessa Pinon, Advisor

Postdoctoral Research Supervision

February 2009 - May 2010, Yan-Hua Zhai, Supervisor

Undergraduate Honors Thesis

March 2012 - Present, Nancy Duque, Advisor

August 2011 - Present, Michael Lee, Advisor

November 2010 - December 2011, Erick Watanabe, Advisor

September 2010 - May 2011, Bryce Kornreich, Advisor

October 2006 - May 2010, Jeremy Sanborn, Advisor

January 2009 - December 2009, Enemisio Cano, Advisor

June 2008 - June 2009, Leily Kiani, Advisor

Undergraduate Research Supervision

May 2012 - Present, Robin Roces, Supervisor

May 2011 - May 2012, Alessandro Castelli, Advisor

May 2009 - August 2009, Paul Tranquilli, Advisor

October 2008 - May 2009, Adam Tan, Advisor

August 2008 - May 2009, Katie Copenhagen, Advisor

May 2007, Allisa Clemens, Advisor

May 2007, Christiane Pailo, Advisor

SERVICE

Department Service

Chair, Physics curriculum advisory committee. (September 2011 - Present).

Organizer, Graduate admissions committee - Bioengineering and small scale technology graduate group. (August 2008 - Present).

Member, Bioengineering and small scale technology (BEST) graduate group. (July 2007 - Present).

Member, Physics and Chemistry graduate group. (July 2006 - Present).

Member, Physics and Chemistry Graduate Admissions Committee. (November 2010 - September 2011).

Member, Physics curriculum advisory committee. (September 2008 - September 2011).

Member, Physics and chemistry search committees. (October 2006 - June 2011).

Organizer, Colloquium and seminar organizer. (July 2009 - December 2010).

Chair, Graduate admissions committee - Physics and chemistry. (August 2009 - November 2010).

Organizer, Colloquium and Seminar organizer. (October 2006 - June 2007).

University Service

Advisor, UC Merced SAE. (October 2010 - Present).

Organizer, Summer BBQ. (June 2007 - Present).

Member, Undergraduate council (UGC). (August 2009 - July 2011).

Public Service

Organizer, Outreach relationship with Ceres high schools, Ceres, California. (June 2009 - June 2011).

Organizer, Laboratory Open House, Merced, California. (March 2007 - June 2011).

Member, Optical Society of America Student Chapter Outreach Program, Evanston, IL. (1997 - 2003).

ROLAND WINSTON

Curriculum Vitae

Distinguished Professor

School of Natural Science & School of Engineering, University of California, Merced

Educational Background

1956. University of Chicago B.S.

1957. University of Chicago M.S.

1963 University of Chicago Ph.D.

Teaching and Research Experience

1963 - 1964 Assistant Professor, University of Pennsylvania

1964 - 1971 Assistant Professor, University of Chicago

1971 - 1975 Associate Professor, University of Chicago

1975 - Professor, University of Chicago

1989 - 1995 Chairman, Department of Physics, University of Chicago

2003 - Professor, University of California, Merced

2005 - 2006 Chair, Merced Division, Faculty Senate

2006 - Chair, Merced Division, Chancellor Search Committee

Concurrent Positions

1974 – 1979 Physicist, Argonne National Laboratory

1993 - 1996 Visiting Professor, Weizmann Institute, Rehovot, Israel

Societies

Fellow, American Physical Society

Fellow, American Optical Society

Fellow, American Association for the Advancement of Science

Fellow, American Solar Energy Society (BOD, 1987-1992)

International Solar Energy Society (BOD, 1991-1994)

SPIE

Awards

1976 IR-100 Award - Dielectric Compound Parabolic Concentrator

1977 IR-100 Award - Nonimaging Solar Collector

1987 Charles Greeley Abbott Award of the American Solar Energy Society

1996 The Franklin Institute C. Raymond Kraus Gold Medal

1999 ICICI (India) International Solar Energy Personality of the Year 1999

2001 Farrington Daniels Award of the International Solar Energy Society

2004 Building Green award top 10 solar collector (Winston series CPC made in Chicago by Solargenix)

2006 UC Merced First Chancellor's Award including the Professor Roland Winston Endowed Scholarship

2006 ASME First Frank Kreith Energy Award

2008 University of Chicago, Alumni Award for Professional Achievement

2009 Optical Society of America, Joseph Fraunhofer Award / Robert M. Burley Prize for Nonimaging Optics

2009 SPIE, A. E. Conrady Award for Nonimaging Optics and Solar Energy

Fellowships

1959 - 1960 Shell Fellow, University of Chicago

1967 - 1969 Alfred P. Sloan Foundation Fellow

1977 - 1978 John Simon Guggenheim Memorial Foundation Fellow

Other Activities

Advisor to California Energy Commission for Photovoltaic research, 2006

Director of UC MERI, 2008-2009

Director of California Advanced Solar Technologies Institute (CAST) A multi-campus research institute comprising UC Berkeley, UC Santa Barbara and UC Merced. 2009-Present

Research Support

US Government Support

1. Nonimaging Optics:

DOE Basic Energy Science continuous support since 1981. During 1998-2002 the annual level was approx. \$200,000

2. Solar Energy:

Founded the Solar Energy Group at Argonne National Laboratory. 1974-1986 support \$6,000,000

Nationally and Internationally, the investment in evacuated tubular solar thermal collectors, mainly using Nonimaging Concentration 1976-1989 was \$9,500,000 according to Office of Solar Applications and of Solar Heat Technology, DOE.

3. Experimental High Energy Physics:

Supported since 1967 by AEC, NSF, DOE. During 1996-2001 the annual support level approx. \$400,000

State of California Support

California Energy Commission: PIER Concentrating photovoltaic grant, 2005-2006, \$75,000

California Energy Commission: PIER Concentrating Solar Thermal project, 2006 – 2008, \$1,350,000

California Energy Commission PIER Concentrating photovoltaic system with micro-inverters, 2009-2012, \$258,115+ \$400,000 industry match

Publications

over 200 Journal publications

5 books

over 60 US Letters Patents

Private Support for Nonimaging Optics and Solar Energy:

The investment by Duke Solar Energy and associated companies (1995-present) has been in excess of \$10,000,000 to date.

Gifts approx. \$115,000, 1995-Present from:

- Weizmann Institute of Science (Irving Wein, donor)
- Koto Electric
- Wyn Foundation, Inc.

Solfocus gift, 2004, \$100,000

H2Go Corporation, 2004-2005, \$100,000

California Community Fund, 2008, \$2,000,000

Dedalos, an International Concentrating PV study, 2008-present, \$1,200,000..

University of California, Office of the President

California Advanced Solar Technologies Institute, 2010-2015, \$2,250,000

References:

Arthur Rosenfeld, Commissioner, California Energy Commission and University of California, Berkeley, Arosenfe@energy.state.ca.us

Dr. Eugene D. Commins, Professor Emeritus of Physics, University of California, Berkeley, eugenecommins@earthlink.net

Antonio Luque, Institute of Solar Energy, University Polytechnica of Madrid, luque@ies-def.ump.es

Dr. Arno Penzias, New Enterprises Associates, Menlo Park, CA, apenzias@nea.com

Professor Yoichiro Nambu, Dept of Physics, University of Chicago, nambu@theory.uchicago.edu or yoichiro.nambu@sbcglobal.net or ynambu0511@r9.dion.ne.jp

Professor Nicola Cabibbo, Department of Physics, University of Rome-La Sapienza and INFN, Sezione di Roma 1, Piazzale A. Moro 5, 00185 Rome, Italy, nicola.cabibbo@roma1.infn.it

UC Merced Students

Uday Bali

Kevin Balkosky

Steve Hill

Heather Poiry

Alfonso Tovar-Fonseca

Jesus Cisneros

Luke Reed

Chunhua Wang

Lun Jiang

LIST OF PUBLICATIONS (Journal Articles)

1. Comments on Farago's Treatment of Spin Precession in Crossed Magnetic and Electric Fields, with V. L. Telegdi, Proc. Phys. Soc. Lond. 74, 782-86 (1959)
2. A Dynamical Interpretation of the Thomas Precession, with V. L. Telegdi, Helv. Phys. Acta - Suppl. V, 249-52 (1960)
3. Measurement of the Muon Mass by Critical Mesic X-Ray Absorption. I. Scintillation Spectrometry, with J. F. Lathrop, R. A. Lundy, V. L. Telegdi, and D. D. Yovanovitch, Il Nuovo Cimento 17, 109-13 (L) (1960).
4. Measurement of the Muon Mass by Critical Mesic X-Ray Absorption. II. Proportional Counter Spectrometry, with J. F. Lathrop, R.A. Lundy, S. Penman, V.L. Telegdi, D.D. Yovanovitch, and A. Bearden, Il Nuovo Cimento 17, 114-18 (L) (1960).
5. X-Ray Yields in the K and L. Series of μ -Mesonic Atoms, with J. L. Lathrop, R. A. Lundy and V.L. Telegdi, Phys. Rev. Lett. 7, 147-50 (1961).
6. Measurements of Muon Disappearance Rates vs Time in C, Mg, Al, Si and P, with J. L. Lathrop, R. A. Lundy, V.L. Telegdi, and D. D. Yovanovitch, Phys. Rev. Lett. 7, 107-09 (1961).
7. Fast Atomic Transitions Within μ -Mesonic Hyperfine Doublets, and Observable Effects of the Spin Dependence of Muon Absorption, with V.L. Telegdi, Phys. Rev. Lett. 7, 104-07- (1961).
8. Experimental Proof of the Spin Dependence of the Muon Capture Interaction, and Evidence for its (F-GT) Character, with G. Culligan, J. F. Lathrop, R. A. Lundy, and V. L. Telegdi, Phys, Rev. Lett. 7, 458-60 (1961).
9. Observation of the Hyperfine Effect in Muon Capture by $^{9}\text{F}19$ via the Time- Dependence of the Decay Electron Rate, with R. A. Lundy, W. A. Cramer, G. Culligan and V. L. Telegdi, Il Nuovo Cimento 24, 549-53 (L) (1962).
10. Muon Capture Rates for $\text{Ca}44$ and $\text{Ca}40$: Observation of the Isotope Effect, with W. A. Cramer, R. A. Lundy, and V. L. Telegdi, Il Nuovo Cimento 24, 546-48 (L) (1962).
11. Observable Hyperfine Effects in Muon Capture by Complex Nuclei, Phys. Rev. 129, 2766 (1963).

Roland Winston
Curriculum Vitae
List of Publications (cont.)

12. Moderation Time for Nuclear Capture of Negative Pions in Liquid He₄,
with M. M. Block, T. Kikuchi, D. Koetke, J. Kopelman, C. R. Sun, R. Walker,
G. Culligan, and V. L. Telegdi, Phys. Rev. Lett. 11, 301 (1963).
13. An Efficient Light Coupler for Threshold Cerenkov Counters,
with H. Hinterberger, Rev. Sci. Instrum. 37, 1094 (1966).
14. Time Dependence of Ke₃₀ Decays,
with L. Feldman, S. Frankel, V. L. Highland, T. Sloan, O. B. Van Dyck,
W. D. Wales, and D. M. Wolfe, Phys. Rev. 155, 1611 (1967).
15. Efficient Design for Lucite Light Pipes Coupled to Photomultipliers,
with H. Hinterberger, Rev. Sci. Instrum. 39, 419 (1968).
16. Use of a Solid Light Funnel to Increase Phototube Aperture without
Restricting Angular Acceptance,
with H. Hinterberger, Rev. Sci. Instrum. 39, 1217 (1968).
17. Differential Production Cross Sections of Low-Momentum Particles
from 12.3-Bev/c Protons on Beryllium and Copper,
with Marmer, Reibel, Schwartz, Stevens, Wolfe, Rush, Phillips, Swallow, and Romanowski,
Phys. Rev. 179, 1294 (1969).
18. Effective-Hamiltonian Approach to Hyperon Beta Decay,
with J. Watson, Phys. Rev. 181, 1907 (1969).
19. Active Magnetic Shielding of Photomultiplier,
with L. Lavoie, Rev. Sci. Instrum. 40, 1350 (1969).
20. Light Collection within the Framework of Geometrical Optics,
J. Opt. Soc. Am. 60, 245 (1970).
21. The Design and Performance of a Gas Cerenkov Counter with Large Phase-
Space Acceptance,
with Hinterberger, Lavoie, Nelson, Sumner, Watson, and Wolfe,
Rev. Sci. Instrum. 41, 413 (1970).
22. Beta Decay of Hyperons,
with R. Oehme and A. Garcia, Phys. Rev. 3D, 1618 (1971).
23. Retinal Cone Receptor as an Ideal Light Collector,
with J. Enoch, J. Opt. Soc. Am. 61, 1120-21 (1971).

Roland Winston
Curriculum Vitae
List of Publications (cont.)

24. Measurement of the Up-Down Asymmetries in the β Decay of Polarized Λ Hyperons, with J. Lindquist, R. Sumner, J. Watson, D. Wolfe, P. R. Phillips, E. C. Swallow, K. Reibel, D. Schwartz, A. Stevens, and T.A. Romanowski, Phys. Rev. Lett. 27, 612-16 (1971).
25. Direct Momentum Determination of a Medium-Energy Particle Beam Using Time-of-Flight and Range Techniques, with A. J. Stevens, D.M. Schwartz, C. J. Rush, K. Reibel, T. A. Romanowski, R. L. Sumner, E. C. Swallow, J. M. Watson, and D. M. Wolfe, Nuc. Instrum. Meth. 97, 207-10 (1971).
26. The Relative Sign of Strangeness Changing Axial Vector and Vector Currents, with R. Oehme and E. C. Swallow, Phys. Rev. D 8, 2124-29 (1973).
27. Search for Structure in π -p \rightarrow Λ Ko at Σ K Threshold, with B. Nelson, T. M. Knasel, J. Lindquist, P. R. Phillips, K. Reibel, T. A. Romanowski, D. M. Schwartz, A. J. Stevens, R. L. Sumner, E. C. Swallow, J. M. Watson, and D. M. Wolfe, Phys. Rev. Lett. 31, 901-04 (1973).
28. Principles of Solar Concentrators of a Novel Design, Sol. Energy 16, 89-95 (1974).
29. Principles of Cylindrical Concentrators for Solar Energy, with H. Hinterberger, Sol. Energy 17, 255-58 (1975).
30. The Visual Receptor as a light Collector, Topics in Modern Physics, Springer Series in Optical Sciences 23, 225-236 (1981).
31. Experimental Study of the Reaction π - p \rightarrow Λ Ko at Beam Momenta between 930 and 1130 MeV/c, with T. M. Knasel, J. Lindquist, B. Nelson, R. L. Sumner, E. C. Swallow, D. M. Wolfe, P. R. Phillips, K. Reibel, D. M. Schwartz, A. J. Stevens, T. A. Romanowski, and J. M. Watson, Phys. Rev. D 11, 1-13 (1975).
32. Experimental Measurement of the Form Factors of the Decay $K_L \rightarrow \pi^\pm e + \gamma$, with R. Blumenthal, S. Frankel, J. Nagy, L. Resvanis, O. Van Dyck, R. Werbeck, and V. Highland, Phys. Rev. Lett. 34, 164-68 (1975).
33. The Corneal Cones of Limulus as Optimised Light Concentrators, with R. Levi-Setti and D. A. Park, Nature, 253, 115-16 (1975).
34. The Heat Trap: An Optimized Far Infrared Field Optics System, with D. A. Harper, R. H. Hildebrand, and R. Stiening, Appl. Opt. 15, 53 (1976).

Roland Winston
Curriculum Vitae
List of Publications (cont.)

35. Dielectric Compound Parabolic Concentrators,
Appl. Opt. 15, 291 (1976).
36. On the Use of Solid-Dielectric Compound Parabolic Concentrators with
Photovoltaic Devices,
with N. B. Goodman, R. Ignatius, and L. Wharton, App. Opt. 15, 2434 (1976).
37. Ideal Concentrators for Finite Sources and Restricted Exit Angles,
with A. Rabl, Appl. Opt. 15, 2880 (1976).
38. Submillimeter Photometry of Extragalactic Objects,
with R. H. Hildebrand, S. E. Whitcomb, R. F. Stiening, D. A. Harper,
and S. H. Mosley, Ap. J. 216, 698 (1977).
39. Lens-Mirror Combinations with Maximal Concentration,
with M. Collares-Pereira and A. Rabl, Appl. Opt. 16, 2677 (1977).
40. Measurement of the Angular Correlation Parameter in the β Decay of
Polarized Δ Hyperons,
with J. Lindquist, et al., Phys. Rev. D 16, 2104 (1977).
41. Submillimeter Observations of the Galactic Center,
with R. H. Hildebrand, S. E. Whitcomb, R. F. Stiening, D. A. Harper,
and S. H. Mosley, Ap. J. 219, L101 (1978).
42. Cone Collector for Finite Sources,
Applied Optics 17, 688 (1978).
43. Two-dimensional Concentrators for Inhomogeneous Media,
with W. T. Welford, J. Opt. Soc. Am. 68, 289 (1978).
44. On the Problem of Ideal Flux Concentrators,
with W. T. Welford, J. Opt. Soc. Am. 68, 531 (1978).
45. Ideal Flux Concentrators with Reflector Gaps,
Applied Optics 17, 1668 (1978).
46. Two Dimensional Nonimaging Concentrators with Refracting Optics,
with W. T. Welford, J. Opt. Soc. Am. 69, 917 (1979).
47. On the Problem of Ideal Flux Concentrators: Addendum,
with W. T. Welford, J. Opt. Soc. Am. 69, 367 (1979).

Roland Winston
Curriculum Vitae
List of Publications (cont.)

48. The Geometrical Vector Flux and Some New Nonimaging Concentrators, with W. T. Welford, *J. Opt. Soc. Am.* 69, 532 (1979).
49. Ideal Flux Concentrators as Shapes Which Do Not Disturb the Geometrical Vector Flux Field: A New Derivation of the compound Parabolic Concentrator, with W. T. Welford, *J. Opt. Soc. Am.* 69, 536 (1979).
50. Cavity Enhancement by Controlled Directional Scattering, *Appl. Opt.* 19, 195 (1980).
51. Solar Collector for Low and Intermediate Temperature Applications, with F. Kreith, G. O. G. Lof, and A. Rabl, *Prog. Energy Combust., Sci.* 6, 1 (1980).
52. Absorption Enhancement in Solar Collectors by Multiple Reflections, with J. O'Gallagher, A. Rabl and W. McIntire, *Solar Energy* 24, 323 (1980).
53. Design of Nonimaging Concentrators as Second Stages in Tandem with Image-forming First-stage Concentrators, with W. T. Welford, *Appl. Opt.* 19, 347 (1980).
54. Measurement of the Electron Asymmetry in the Beta Decay of Polarized Sigma Minus Hyperons, with P. Keller, A. Lesnik, T.A. Romanowski, W.E. Keig, B. Nelson, D.A. Park, E.C. Swallow, C.A. Ward and J. Watson, *Phys. Rev. Lett.* 48, 971 (1982).
55. The Ellipsoid Paradox in Thermodynamics, with W. T. Welford, *J. Stat. Phys.* 28, 603 (1982).
56. An Upper Bound on the Efficiency of Certain Nonimaging Concentrators in the Physical Optics Model, *J. Opt. Soc. Am.* 72, 1244 (1982).
57. Nonconventional Optical Systems and the Brightness Theorem, with W. T. Welford, *Appl. Opt.* 21, 1531 (1982).
58. The Efficiency of Nonimaging Concentrators in the Physical Optics Model, with W. T. Welford, *J. Opt. Soc. Am.* 72, 1564 (1982).
59. Throughput of Diffraction-Limited Field Optics Systems for Infrared and Millimetric Telescopes, with R. H. Hildebrand, *Appl. Opt.* 21, 1844 (1982).
60. Development of Compound Parabolic Concentrators for Solar Energy, with J. O'Gallagher, *Internat. J. Amb. Energy* 4, 171 (1983).
61. Limits to Concentration in Physical Optics and Wave Mechanics, with I. M. Bassett, *Optica Acta* 31, 499 (1984).
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213. Size- and structure-dependent efficiency enhancement for luminescent solar concentrators Chunhua Wang, Winston, R., Weiya Zhang, Pelka, D., Carter, S., Journal of Photonics for Energy Vol. 1 Issue 1 DI 10.1117/1.3534864, 1 Jan. 2011
214. Simple Kohler Homogenizers for Image-forming Solar Concentrators, Winston, Roland, Zhang, Weiya, Dimroth, F; Kurtz, S; Sala, G; Bett, Journal of Photonics for Energy, Vol. 1 Issue 1 Pages: 015503 (9 pp), Jan. 2011
215. Precision measurement of the ratio $BR(K-S \rightarrow \pi^+\pi^-e^+e^-)/BR(K-L \rightarrow \pi^+\pi^-\pi^0(D))$, Author(s): Batley J. R.; Kalmus G. E.; Lazzeroni C.; et al, PHYSICS LETTERS B Volume: 694 Issue: 4-5 Pages: 301-309, Published: JAN 3 2011
216. New measurement of the $K^{+/-} \rightarrow \pi^{+/-}\mu^+\mu^-$ decay, Batley J. R.; Kalmus G.; Lazzeroni C.; et al., NA48 2 Collaboration, PHYSICS LETTERS B Volume: 697 Issue: 2 Pgs: 107-115, FEB 28 2011
217. Test of lepton flavour universality in $K^+ \rightarrow l^+\nu$ decays, Lazzeroni C.; Romano A.; Ceccucci A.; et al., NA62 Collaboration, PHYSICS LETTERS B Volume: 698 Issue: 2 Pgs: 105-114, APR 4 2011
218. Thermodynamically efficient solar concentrators, Winston, R., Journal of Photonics for Energy, 2, 025501, APR 27, 2012

Roland Winston
Curriculum Vitae

Books

Optics of Nonimaging Concentrators: Light and Solar Energy,
with W. T. Welford, Academic Press, San Diego, CA (1978).

High Collection Nonimaging Optics,
with W. T. Welford, Academic Press, New York, NY (1989).

Selected Papers on Nonimaging Optics,
Roland Winston, Editor, SPIE Milestone Series, Volume MS 106 (1995).

Nonimaging Optics,
with J. C. Minano and P. Benitez, Academic Press (Elsevier) (2005), ebooks.com 2006.

ISSUED US LETTERS PATENTS

PAT. NO. Title

1. 6,335,999 Multilayer luminaire device
2. 6,244,264 Non-imaging optical illumination system
3. 6,205,998 Solar concentrator gap and receiver design
4. 6,177,761 LED with light extractor
5. 6,044,840 Nonimaging solar collector
6. 6,044,196 Luminaire device
7. 6,019,485 Nonimaging optical illumination system
8. 6,002,829 Luminaire device 21
9. 5,971,551 Nonimaging optical concentrators and illuminators
10. 5,967,140 Nonimaging solar collector
11. 5,927,271 Nonimaging solar collector
12. 5,816,693 Nonimaging optical illumination system
13. 5,610,768 Nonimaging radiant energy device
14. 5,594,830 Luminaire device
15. 5,586,013 Nonimaging optical illumination system
16. 5,557,478 Nonimaging radiant energy device
17. 5,537,991 Nonimaging solar collector
18. 5,528,720 Tapered multilayer luminaire devices
19. 5,491,620 Light source illumination system
20. 5,416,325 Fourier transform infrared spectrometer
21. 5,335,152 Nonimaging optical illumination system
22. 5,303,322 Tapered multilayer luminaire devices
23. 5,289,356 Nonimaging optical illumination system
24. 5,243,459 Nonimaging radiant energy device
25. 5,237,641 Tapered multilayer luminaire devices
26. 5,005,958 High flux solar energy transformation
27. 4,956,759 Illumination system for non-imaging reflective collector
28. 4,483,007 Energy transmission with respect to convex sources and receivers

Roland Winston
Curriculum Vitae

Issued US Letters Patents (cont.)

29. 4,387,961 Compound parabolic concentrator with cavity for tubular absorbers
30. 4,359,265 Controlled directional scattering cavity for tubular absorbers
31. 4,240,692 Energy transmission
32. 4,237,332 Nonimaging radiant energy direction device
33. 4,230,095 Ideal light concentrators with reflector gaps
34. 4,130,107 Solar concentrator with restricted exit angles
35. 4,114,592 Cylindrical radiant energy direction device with refractive medium
36. 4,045,246 Solar cells with concentrators
37. 4,003,638 Radiant energy collection
38. 4,002,499 Radiant energy collector
39. 3,957,031 Light collectors in cylindrical geometry
40. 20060207650 Multi-junction solar cell with an aplanatic imaging system and coupled non-imaging light concentrator
41. 20080271731 Solar Collectors With Evacuated Receiver And Nonimaging External Reflectors
42. 20080266664 Liquid light pipe with an aplanatic imaging system and coupled non-imaging light concentrator
43. 20080245401 Concentrating Photovoltaic System Using A Fresnel Lens And Nonimaging Secondary Optics

Patents pending:

Aplanatic concentrator with total internal reflection (2008)

Multi-Junction Solar Cells With A Homogenizer System: Application number: 11/683,934,
Publication number: US 2008/0047605 A1 (2007)

Nonimaging Concentrators with Kohler illumination (2007)

Nonimaging concentrator for multi junction solar cells with Kohler illumination Nonimaging (2007)

Nontracking solar thermal collector for high temperature (2007)

Nonimaging concentrating illumination for daylighting (2006)

Multi-junction solar cells with an aplanatic imaging system and coupled non-imaging light concentrator Pub No: 2006/0207650
(Licensed to Solfocus) (2006)

Roland Winston
Curriculum Vitae

Review Articles and Chapters

1. Principles of Optics Applied to Solar Energy Concentrators,
with W. T. Welford, Solar Energy Handbook, Jan F. Kreider and Frank Kreith Editors,
McGraw-Hill, 1981
2. Applications of Maximally Concentrating Optics for Solar Energy Collection,
with J. O'Gallagher, in Energy Sources: Conservation and Renewables, AIP
Conference Proceedings, Number 135, ed. by Hafemeister, et al., American Inst.
Physics, N. Y., 1985.
3. Nonimaging Concentrators (Optics),
with J. O'Gallagher, "Encyclopedia of Physical Science and Technology, Vol. 9,
Academic Press, Inc., 1987.
4. Nonimaging Optics for Flux Concentration,
with I. M. Bassett and W. T. Welford, Progress in Optics XXVII, ed. by E. Wolf,
Elsevier Science Publishers B. V., 1989.
5. Optical Research and Development,
Ch 7, Vol.5 in Solar Heat Technologies: Fundamentals and Applications,
pgs 305-357, The MIT Press (1990).
6. Nonimaging Concentrators (Optics),
with J. O'Gallagher in Encyclopedia of Lasers and Optical Technology, pgs. 319-330,
Academic Press (1991)
7. Attaining and Using Extremely High Intensities of Solar Energy with Non-Imaging
Concentrators,
with D. Jenkins, J. J. O'Gallagher and R. Winston, Advances in Solar Energy, Volume 11,
Chapter 2, Karl W. Böer, Editor, American Solar Energy Society, Inc., [1997]
8. Optics,
with W. T. Welford, 20-40 -20-58 in The CRC Handbook of Mechanical Engineering,
Frank Kreith, Editor (1998)
9. Solar Concentrators,
Chapter 7 in *SOLAR ENERGY, THE STATE OF THE ART*, ISES POSITION PAPERS,
R. Winston, Jeffrey Gordon (Editor), James & James, London (2001) pgs 357-436.
10. Semileptonic Hyperon Decays,
Annual Reviews of Nuclear and Particle Science, Nicola Cabibbo, Roland Winston,
Chris Quigg (Editor), 2003 Vol. 53, pgs 39-75. 23
11. Tribute to Emil Wolf: Science and Engineering Legacy of Physical Optics
Chapter 7, Paradigm for a Wave Description of Optical Measurements, pgs. 153-166,
R. Winston, R. Littlejohn, Y. Sun, K.A. Snail, SPIE Press (2004)

Roland Winston
Curriculum Vitae

Conference series on Nonimaging Optics (since 1991, under SPIE auspices)
(Founder and Chair, R. Winston, source material for development of the subject over the past decade)

Nonimaging Optics: Maximum Efficiency Light Transfer

I Volume 1528 1991
II Volume 2016 1993
III Volume 2538 1995
IV Volume 3139 1997
V Volume 3781 1999
VI Volume 4446 2001
VII Volume 5185 2003

Nonimaging Optics and Efficient Illumination Systems

I 2004 Volume 5529
II 2005 Volume 5942
III 2006 Volume 6338
IV 2007 Volume 6670
V 2008 Volume 7059

July 27, 2012

Curriculum Vitae Kevin A. Mitchell

School of Natural Sciences
University of California, Merced
5200 North Lake Road, Merced, CA 95343
(209)228-2952 (office); (209)201-3471 (cell)
kmitchell@ucmerced.edu

Associate professor and founding faculty at the University of California, Merced.

Research Interests

- Nonlinear dynamics and chaos; applications to atomic and molecular physics; chaotic ionization and scattering; chaos in ultracold gases and Bose-Einstein condensates; semi-classical phase-space techniques; symbolic and topological dynamics.
- Geometric/Berry phase and gauge theory; rotation-vibration coupling.

Education

Ph.D. Physics University of California at Berkeley, Spring 2000.
M.A. Physics University of California at Berkeley, Spring 1998.
B.S. Physics/Math (with honors) Carnegie Mellon University, Spring 1994.

Previous employment and extended research visits

College of William and Mary

Postdoctoral researcher in atomic physics and quantum chaos with Professor John Delos; Williamsburg, VA, Sept. 2000 – Aug. 2004.

Mathematical Sciences Research Institute

Member of the program on Semi-Classical Analysis; Berkeley, CA, April/May 2003.

University of Warwick

Visiting researcher with the Warwick Symposium on Geometric Mechanics and Symmetry; Coventry, UK, March/April 2002.

University of California at Berkeley

Graduate student; thesis adviser: Robert G. Littlejohn; thesis title: “Shape and Orientation: A Gauge Theoretical Approach”; June 1995 – May 2000.

Università di Perugia

Visiting researcher collaborating with Profs. Vincenzo Aquilanti and Simona Cavalli, Department of Chemistry; Perugia, Italy, Aug. 1997, June 1998.

Grants

NSF CAREER Award: “Chaotic transport - from fundamental theory to applications in atomic physics”; Amount: \$400K of total funding; Term: July 2008-June 2013.

UC Merced GRC grants: 2011-2012 (\$5,000); 2009-2010 (\$2,255); 2008-2009 (\$2,500); 2006-2007 (\$1,100).

Teaching

UC Merced

Fall 2005, Spring 2006, Fall 2006, Spring 2007, Fall 2007: I cotaught the interdisciplinary course Integrated Calculus and Physics (ICP), a double course comprising the first semesters of both Physics and Calculus. I served as the lead instructor for the development, implementation, and teaching of ICP.

Fall 2007, Fall 2008: PHYS 237: Quantum Mechanics I (first semester, graduate level quantum mechanics). This was the first time this course was offered at UCM.

Spring 2009, Spring 2010, Spring 2011: I taught two (half-semester) minicourses, PHYS 124: Rotational Mechanics Minicourse and PHYS 126: Special Relativity Minicourse. This was the first time these courses were offered at UCM.

Spring 2010, Spring 2011: Freshman Seminar, Core 90: Modern World of the Quantum.

Graduate students: Current graduate student: Roxanne Moran (since Spring 2011; Physics). Former students: Korana Burke (Fall 2005–Spring 2011; Ph.D. in Physics), Haik Stepanian (Fall 2008–Summer 2010; MS in Applied Math).

Undergraduate student thesis research: Former: Natalie Hall (BS Physics 2010), Jared Petker (BS Physics 2010), Matt Feenstra (BS Physics 2011).

UC Berkeley

Graduate student instructor in the Berkeley physics department; Fall 1994, Spring 1995, Fall 1997, Spring 2000.

Service

Society of Industrial and Applied Mathematics (SIAM)

Coorganizer (with Pieter Collins of Centrum voor Wiskunde en Informatica) of the minisymposium *Topological Methods for Low Dimensional Chaotic Systems* at the 2007 SIAM Conference on Applications of Dynamical Systems.

Coorganizer (with Predrag Cvitanovic of Georgia Tech) of the minisymposium *Periodic Orbits in Classical and Quantum Dynamics* at the 2011 SIAM Conference on Applications of Dynamical Systems.

Journal Reviewer

Peer reviewer for Phys. Rev. Lett., Phys. Rev. A, J. Phys. A, J. Phys. B, J. Phys: Condensed Matter, J. Electron Spectroscopy and Related Phenomena, Chaos, Physica D, Entropy, AIP Proceedings.

UC Merced

As a founding faculty member, I have served numerous roles in the development of UC Merced, especially with respect to the physics program. A select list follows.

UC Merced Senate Committee on Committees (2005-2007)

UC Merced Parking Committee (2005)

Natural Sciences Academic Resources and Planning Committee (ARPC) (2006-2008): As a member of ARPC and its predecessor, the Strategic Planning Committee, I have been responsible for successfully proposing and developing the strategic plan in the core research area of Atomic, Molecular, and Optical Physics.

Natural Sciences Strategic Planning Committee (2004-2006)

Natural Sciences Curriculum Committee (2005-2006, 2008-2011)

Natural Sciences Space Committee (2005)

Natural Sciences Executive Council (2007-2008)

Faculty Search Committees: Member of the search committees for Physics and Applied Math (2004-2005), Materials (2006), Biophysics (2007-2008), Condensed Matter (2008-2009), Biophysics/Soft Matter (2010-2011). Chair of the Atomic, Molecular, and Optical Physics search committee (2005-2006, 2007-2008), which successfully recruited a total of four assistant professors. Chair of Physics senior search committee (2009-2010). Member of the search committee for the Dean of Natural Sciences (2010-2011).

Faculty Lead for the Physics Major (2004-2011): I spearheaded the effort to develop, assess, revise, and implement the Physics major and minor. Since the arrival of the first physics majors in 2006, I have actively engaged in recruiting and advising physics students.

Physics Faculty Assessment Organizer (FAO) for WASC accreditation (2008-2011): I was responsible for the Physics component of the University's accreditation efforts.

Outreach

NorCal Science Olympiad State Finals (2007): Coordinated, ran, and judged the Science Olympiad Physics competition.

Higher Education Consortium of Central California (2004-2007): Faculty contact for physics education.

Challenger Frontiers of Science and Engineering Lecture Series (2006): Public speaker

World of Physics (2007): Public speaker for Physics recruitment lecture series.

Select honors and awards

NSF CAREER Award

“Chaotic transport from fundamental theory to applications in atomic physics”; 2008.

Outstanding Graduate Student Instructor Award

Presented by the University of California, Berkeley, after first year of teaching; 1995.

Richard E. Cutkosky Alumni Award

One of two awards presented by Carnegie Mellon University for the most promising graduates in physics; 1994.

Bibliography

Refereed Publications

Kevin A. Mitchell and John Mahoney, “Invariant manifolds and the geometry of front propagation in fluid flows”, submitted to *Chaos* (2012).

Kevin A. Mitchell, “Partitioning two-dimensional mixed phase spaces” , *Physica D*, in press (2012).

Tommy A. Byrd, Megan K. Ivory, Andrew J. Pyle, Seth Aubin, Kevin A. Mitchell, John B. Delos, and Kunal K. Das, “Scattering by an oscillating barrier: Quantum, classical, and semiclassical comparison”, *Phys. Rev. A* **86**, 013622 (2012).

John Mahoney, Dylan Bargteil, Mark Kingsbury, Kevin Mitchell, and Tom Solomon, “Invariant barriers to reactive front propagation in fluid flows”, *Europhys. Lett.* **98**, 44006 (2012).

K. Burke, K. A. Mitchell, B. Wyker, S. Ye, F. B. Dunning, “Demonstration of Turnstiles as a Chaotic Ionization Mechanism in Rydberg Atoms”, *Phys. Rev. Lett* **107**, 113002 (2011).

Kevin A. Mitchell and Boaz Ilan, “Nonlinear enhancement of the fractal structure in the escape dynamics of Bose-Einstein condensates”, *Phys. Rev. A* **80**, 043406 (2009).

Korana Burke and Kevin A. Mitchell, “Chaotic ionization of a Rydberg atom subjected to alternating kicks: Role of phase space turnstiles”, *Phys. Rev. A* **80**, 033416 (2009).

K. A. Mitchell, “The topology of nested homoclinic and heteroclinic tangles”, *Physica D* **238**, 737 (2009).

K. A. Mitchell and D. A. Steck, “Fractal templates in the escape dynamics of trapped ultracold atoms”, *Phys. Rev. A* **76**, 031403 (2007).

K. A. Mitchell and J. B. Delos, “The structure of ionizing electron trajectories for hydrogen in parallel fields”, *Physica D* **229**, 9 (2007).

R. Winston, A. D. Kim, and K. A. Mitchell, “Measuring radiance: a paradigm for coherence optics in six-dimensional phase space”, *J. Mod. Opt.* **53**, 2419 (2006).

K. A. Mitchell and J. B. Delos, “A new topological technique for characterizing homoclinic tangles”, *Physica D* **221**, 170 (2006).

P. Hansen, K. A. Mitchell, and J. B. Delos, “Escape of trajectories from a vase-shaped cav-

ity”, *Phys. Rev. E* **73**, 066226 (2006).

J. B. Delos and K. A. Mitchell, “Fractal Structure in Ionization Dynamics”, *Few-Body Systems* **38**, 181 (2006).

K. A. Mitchell, J. P. Handley, B. Tighe, A. Flower, and J. B. Delos, “Analysis of Chaos-Induced Pulse Trains in the Ionization of Hydrogen”, *Phys. Rev. A* **70**, 043407 (2004).

K. A. Mitchell, J. P. Handley, B. Tighe, A. Flower, and J. B. Delos, “Chaos-Induced Pulse Trains in the Ionization of Hydrogen”, *Phys. Rev. Lett.* **92**, 073001 (2004).

K. A. Mitchell, J. P. Handley, B. Tighe, S. K. Knudson, and J. B. Delos, “Geometry and Topology of Escape I: Epistrophes”, *Chaos* **13**, 880 (2003).

K. A. Mitchell, J. P. Handley, S. K. Knudson, and J. B. Delos, “Geometry and Topology of Escape II: Homotopic Lobe Dynamics”, *Chaos* **13**, 892 (2003).

Robert G. Littlejohn, Matthew Cargo, Tucker Carrington, Jr., Kevin A. Mitchell, and Bill Poirier, “A general framework for discrete variable representation basis sets”, *J. Chem. Phys.* **116**, 8691 (2002).

Robert G. Littlejohn and Kevin A. Mitchell, “Gauge Theory of Small Vibrations in Polyatomic Molecules” in *Geometry, Dynamics, and Mechanics*, eds. P. Newton, P. Holmes, A. Weinstein (Springer-Verlag, New York, 2002).

Kevin A. Mitchell, “Gauge fields and extrapotentials in constrained quantum systems”, *Phys. Rev. A* **63**, 042112/1-20 (2001).

Kevin A. Mitchell and Robert G. Littlejohn, “Boundary conditions on internal three-body wave functions”, *Phys. Rev. A* **61**, 042502/1-16 (2000).

Kevin A. Mitchell and Robert G. Littlejohn, “Kinematic orbits and the structure of the internal space for systems of five or more bodies”, *J. Phys. A* **33**, 1395 (2000).

Robert G. Littlejohn, Kevin A. Mitchell, and Vincenzo Aquilanti, “Quantum dynamics of kinematic invariants in tetra- and polyatomic systems”, *PCCP* **1**, 1259 (1999).

Kevin A. Mitchell and Robert G. Littlejohn, “The rovibrational kinetic energy for complexes of rigid molecules”, *Mol. Phys.* **96**, 1305 (1999).

Robert G. Littlejohn, Kevin A. Mitchell, Vincenzo Aquilanti, and Simona Cavalli, “Body frames and frame singularities for three-atom systems”, *Phys. Rev. A* **58**, 3705 (1998).

Robert G. Littlejohn, Kevin A. Mitchell, Matthias Reinsch, Vincenzo Aquilanti, and Simona

Cavalli, “Internal spaces, kinematic rotations, and body frames for four-atom systems”, *Phys. Rev. A* **58**, 3718 (1998).

Kevin A. Mitchell and Robert G. Littlejohn, “Derivation of planar three-body hyperspherical harmonics from monopole harmonics”, *Phys. Rev. A* **56**, 83 (1997).

Proceedings

Kevin A. Mitchell, “Periodic orbits and transport in mixed phase spaces”, AIP Conference Proceedings, in press (2012).

Kevin A. Mitchell, “The topology of nested tangles” in Proceedings of the Conference on Nonlinear Science and Complexity, eds. J. A. Tenreiro Machado, Manuel F. Silva, Ramiro S. Barbosa, Lino B. Figueiredo, ISBN 978-972-8688-56-1 (Porto, Portugal, 2008).

K. A. Mitchell, J. P. Handley, B. Tighe, A. A. Flower, S. K. Knudson, and J. B. Delos, “Fractals in Chaotic Escape” in *From the Atomic to the Nano-Scale*, eds. Colm T. Whelan and J. H. McGuire (Old Dominion University, Virginia, 2003).

Invited Conference Talks

“How to partition a mixed phase space”; Workshop on Developments in Quantum Chaos; Cuernavaca, Mexico, 2010.

“The nonlinear enhancement (and analysis) of fractal structure in the escape dynamics of Bose condensates”; SIAM Conference on Applications of Dynamical Systems; Snowbird, UT, 2009.

“Chaotic ionization of a Rydberg atom subjected to alternating kicks”; SIAM Conference on Applications of Dynamical Systems; Snowbird, UT, 2009. (Replacement talk in minisymposium.)

“Homoclinic tangle approach to kicked hydrogen”; Second Conference on Nonlinear Science and Complexity; Porto, Portugal, 2008. (Presented by my student Korana Burke.)

“The topology of nested tangles”; Plasma Theory, Wave Kinetics, and Nonlinear Dynamics; Berkeley, CA, 2007.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; APS DAMOP conference; Tucson, AZ, 2004.

“Pulse Trains, Fractals, and the Ionization of Hydrogen”; workshop on Semi-classical Methods in Physics and Chemistry; Mathematical Sciences Research Institute, Berkeley, CA,

2003.

“Fractal Structures in Escape Dynamics”; Fourth International Conference on Dynamical Systems and Differential Equations (replaced J. Delos in schedule); University of Wilmington, NC, 2002.

“Fractal Escape Time and Chaotic Dynamics”; British Applied Mathematical Colloquium (BAMC); University of Warwick, UK, 2002.

“Chaotic Ionization of Hydrogen in Parallel Fields”; Semi-Classical and Quantum Multibody Problems; workshop at University of Warwick, UK, 2002.

“Constrained Quantum Systems and the Geometric Phase”; The Geometric Phase: Recent Developments and Applications in AMO Physics; workshop at the Institute for Theoretical Atomic and Molecular Physics (ITAMP); co-organized by R. Littlejohn (thesis adviser); Harvard, 1999.

University Seminars

“How to partition a mixed phase space: with applications to atomic physics”; Georgia Tech Nonlinear Science Seminar, 2010.

“Using invariant manifolds to classify chaotic transport pathways in mixed phase space”; Applied Math Seminar; University of Wisconsin, Madison, 2009.

“Chaotic transport in phase space — ionization of a Rydberg atom subjected to external electric field pulses”; Boston University Dynamical Systems Seminar, Boston, 2010. (Presented by my student Korana Burke.)

“Using invariant manifolds to classify chaotic transport pathways in mixed phase space”; UC Davis, 2009.

“Using invariant manifolds to classify chaotic transport pathways in mixed phase space”; Seminar at the Center for Control, Dynamical Systems, and Computation; UC Santa Barbara, 2009.

“The nonlinear enhancement (and analysis) of fractal structure in the escape dynamics of Bose condensates”; College of William and Mary; Williamsburg, VA, 2009.

“Fractal Patterns in the Escape Dynamics of Ultracold Atoms”; Optics and Electronics Seminar; Ginzton Laboratory, Stanford University, 2008.

“Fractal Patterns of Chaotic Escape – with Applications to Atomic Systems”; Instituto de

Ciencias Físicas, Universidad Nacional Autónoma de México; Cuernavaca, Mexico, 2008.

“The Chaotic Escape of Ultracold Atoms from an Optical Trap – a Study in Fractals”; University of Kyoto, 2006.

“The Chaotic Escape of Ultracold Atoms from an Optical Trap – a Study in Fractals”; UC Davis, Computational Science and Engineering, Science of Complex Systems Seminar Series, 2006.

“The Chaotic Escape of Ultracold Atoms from an Optical Trap”; Centrum voor Wiskunde en Informatica (CWI), Amsterdam, 2006.

“Understanding phase space transport through homotopic lobe dynamics”; Applied Math Seminar, UC Berkeley, 2006.

“Homotopic Lobe Dynamics”, Topology Seminar, EPFL, Lausanne, 2005.

“The Topological Structure of Homoclinic Tangles and Implications for Phase Space Escape”, Marsden Group Seminar, Caltech, 2005.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; Oregon Center for Optics, University of Oregon, 2005.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; atomic physics seminar, University of California, Berkeley, 2004.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; Lyon, France, 2004.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; Orsay, France, 2004.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; atomic physics seminar, University of Virginia, 2004.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; Northeastern University, 2004.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; mathematics colloquium, College of William and Mary, 2003.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; University of California, Merced, 2003.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; atomic physics seminar, University of Michigan, Ann Arbor, 2003.

“Fractal Escape Times and the Chaotic Ionization of Hydrogen”; physics colloquium, College of William and Mary, 2003.

“Fractal Escape Times and the Chaotic Ionization of Hydrogen in Parallel Fields”; applied math seminar, Princeton University, 2002.

“Chaotic Ionization of Hydrogen in Parallel Fields”; joint physics/math seminar, University of Nottingham, UK, 2002.

“Chaotic Ionization of Hydrogen in Parallel Fields”; dynamics seminar, SUNY, Stony Brook, 2002.

Contributed Presentations

“How to partition a mixed phase space”; Dynamics Days, Chicago, 2010.

“Ionization and scattering rates computed from classical periodic orbit theory”; APS DAMOP meeting, Houston, TX, 2010.

“Chaotic Phase Space of a Hydrogen Atom in Crossed Electric and Magnetic Fields”; APS March meeting, Portland, OR, 2010. (Presented by my student Korana Burke.)

“Turnstile Approach to Ionization of the Hydrogen Atom in Crossed Fields”; APS DAMOP meeting, Houston, TX, 2010. (Presented by my student Korana Burke.)

“Chaotic ionization of a Rydberg atom subjected to alternating kicks”; APS DAMOP conference; Charlottesville, VA, 2009. (Presented by my student Korana Burke.)

“Phase Space Transport and the Ionization of Kicked Rydberg Atoms”; SIAM Conference on Applications of Dynamical Systems; Snowbird, UT, 2009. (Presented by my student Korana Burke.)

“Symbolic dynamics in mixed Hamiltonian phase spaces”; Dynamics Days; San Diego, CA, 2009.

“Phase Space Transport and the Ionization of Kicked Rydberg Atoms”; Dynamics Days; San Diego, CA, 2009. (Presented by my student Korana Burke.)

“Using invariant manifolds to classify chaotic transport pathways in mixed phase space”; APS March Meeting; Pittsburgh, PA, 2009.

“The topology of nested tangles”; Second Conference on Nonlinear Science and Complexity; Porto, Portugal, 2008.

“The nonlinear enhancement of fractal structure in the escape dynamics of Bose condensates”; APS DAMOP meeting; State College, PA, 2008.

“The topology of nested tangles”; Nonlinear Dynamics and Chaos: Advances and Perspectives; Aberdeen, Scotland, 2007.

“Chaotic escape dynamics of ultracold and Bose-condensed atoms”; APS DAMOP Conference, Calgary, Canada, 2007.

“Topological Methods for Low Dimensional Chaotic Systems – An Overview”; Pieter Collins and Kevin Mitchell, SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, 2007.

“Homoclinic Tangle Approach to Kicked Hydrogen”; Korana Burke and Kevin Mitchell (Graduate student poster), APS DAMOP Conference, Calgary, Canada, 2007.

“Fractal templates in the escape dynamics of trapped ultracold atoms”; Dynamics Days, Boston, MA, 2007.

“Homoclinic Tangle Approach to Kicked Hydrogen”, Korana Burke and Kevin Mitchell (Graduate student poster), Dynamics Days, Boston, MA, 2007.

“Chaotic Escape of Ultracold Atoms from a Double-Gaussian Trap”; APS DAMOP Conference, Knoxville, TN, 2006.

“Homoclinic tangles through homotopic lobe dynamics”; SIAM Conference on Applications of Dynamical Systems, Snowbird, UT, 2005.

“The vase cavity: a model for chaotic ionization”; APS DAMOP Conference, Lincoln, NE, 2005.

“The qualitative structure of chaotic ionizing trajectories”; Dynamics Days, Long Beach, CA, 2005.

“Chaos-Induced Pulse Trains in the Ionization of Hydrogen”; International Workshop on Rydberg Physics; Dresden, Germany, 2004.

“Chaos-Induced Pulse Trains in Escape Dynamics”; American Physics Society March Meeting; Montreal, 2004.

“Chaos-Induced Pulse Trains in Atomic Ionization” (poster); Dynamics Days 2004; Chapel Hill, NC, 2004.

“Homoclinic Tangles and Fractal Escape-Times”; American Physical Society March Meeting; Austin, TX, 2003.

“Fractal Structures in Escape Dynamics”; American Physical Society Meeting, Division of Atomic, Molecular, and Optical Physics (DAMOP); Williamsburg, VA, 2002.

“Chaotic Ionization of Hydrogen in Parallel E and B Fields” (poster); Dynamics Days 2002; Baltimore, MD, 2002.

“Gauge Fields, Geometric Phase, and Constrained Quantum Systems” (poster); Lagrangian and Hamiltonian Methods for Nonlinear Control; workshop sponsored by the International Federation of Automatic Control (IFAC); Princeton, 2000.

“Hyperspherical Harmonics from Monopole Harmonics”; Hyperspherical Harmonic Methods in Atomic, Molecular, and Nuclear Physics; workshop at the Institute for Nuclear Theory; University of Washington, 1999.

Eric Brown - Curriculum Vitae - updated July 6, 2012

Assistant Professor, School of Natural Sciences, University of California, Merced
eric.brown@ucmerced.edu

Education

- 07/2007 Ph. D. Physics, University of California, Santa Barbara (UCSB). Advisor: Guenter Ahlers.
05/2002 B. S. Physics, Harvey Mudd College (HMC). Advisor: Chih-Yung Chen.

Employment

- 08/2011 - present Assistant Professor, School of Natural Sciences, University of California, Merced.
12/2007 - 07/2011 Postdoctoral Scholar, James Franck Institute, University of Chicago.
10/2007 - 11/2007 Postdoctoral Scholar, Dept. of Physics and IQCD, UCSB.
09/2006 - 06/2007 Teaching Associate, College of Creative Studies, UCSB.
04/2004 - 09/2007 Graduate Student Researcher, Dept. of Physics and IQCD, UCSB.
09/2002 - 03/2004 Teaching Assistant, Dept. of Physics, UCSB.
06/2001 - 08/2001 Undergraduate Summer Researcher, Dept. of Engineering, HMC.

Professional service and outreach

- 10/2008 - 12/2009 Organizer for Computations in Science seminar series, University of Chicago.
09/2002 - 09/2007 Physics Circus outreach to elementary school students, UCSB.

Awards

Kadanoff-Rice Postdoctoral Fellowship, 2007.
UCSB Physics Circus Award, 2003, 2004, 2005.
Harvey S. Mudd Merit Award, 2002.

Patents

Universal Gripper Based on Jamming Material (in review).

Publications

1. E. Brown, H. M. Jaeger. The role of dilation and confining stress in shear thickening of dense suspensions. *J. Rheology* **56** (4), 875-923(2012).
2. Q. Xu, N. Oudalov, Q. Guo, H. M. Jaeger, Eric Brown. Effect of oxidation on the Mechanical Properties of Liquid Gallium and Eutectic Gallium-Indium. *Phys. Fluids* **24**, 063101-1-13 (2012).
3. E. Brown, Alice Nasto, Athanasios G. Athanassiadis, H. M. Jaeger. Strain-stiffening in random packings of entangled granular chains. *Phys. Rev. Lett.* **108**, 108302 (2012).
4. J.R. Amend, E. Brown, N. Rodenberg, H.M. Jaeger, H. Lipson, A positive pressure universal gripper based on the jamming of granular material. *IEEE Trans. Robotics* **28** (2), 341-350 (2012).
5. E. Brown, H. Jaeger. Through Thick and Thin. *Science* **333** (6047), 1230-1231 (2011).
6. E. Brown, H. Zhang, N. A. Forman, B. W. Maynor, D. E. Betts, J. M. DeSimone, and H. M. Jaeger. Shear thickening and jamming in densely packed suspensions of different particle shapes. *Phys. Rev. E*, **84**, 031408-1-11 (2011).

7. E. Brown, N. Rodenberg, J. Amend, A. Mozeika, E. Steltz, M. R. Zakin, H. Lipson, H. M. Jaeger. Universal Robotic Gripper based on the Jamming of Granular Material. *Proc. National Academy of Sciences* (Cover) **107**, (44) 18809-18814 (2010).
8. E. Brown, H. Zhang, N. A. Forman, B. W. Maynor, D. E. Betts, J. M. DeSimone, and H. M. Jaeger. Shear thickening in densely packed suspensions of spheres and rods confined to few layers. *J. Rheology* **54**, 1023-1046 (2010).
9. E. Brown, N. A. Forman, C. S. Orellana, H. Zhang, B. W. Maynor, D. E. Betts, J. M. DeSimone, H. M. Jaeger. Generality of shear thickening in suspensions. *Nature: Materials* **9** (3) 220-224 (2010).
10. E. Steltz, A. Mozeika, N. Rodenberg, E. Brown, H. M. Jaeger. JSEL: Jamming Skin Enabled Locomotion. *Proceedings of the IEEE International conference on Intelligent Robots and Systems, Oct. 10-15 2009*. 5672-5677 (2009).
11. E. Brown, H. M. Jaeger. Dynamic jamming point for shear thickening suspensions. *Phys. Rev. Lett.* **103**, 086001 (2009).
12. E. Brown, G. Ahlers. The origin of oscillations of the large-scale circulation of turbulent Rayleigh-Bénard convection. *J. Fluid Mech.* **638**, 383-400 (2009).
13. E. Brown, G. Ahlers. Azimuthal asymmetries of the large-scale circulation in turbulent Rayleigh-Bénard convection. *Phys. Fluids* **20** 105105-1-15 (2008).
14. E. Brown, G. Ahlers. A model of diffusion in a potential well for the dynamics of the large-scale circulation in turbulent Rayleigh-Bénard convection. *Phys. Fluids* **20**, 075101-1-16 (2008).
15. D. Funfschilling, E. Brown, G. Ahlers. Torsional oscillations of the large-scale circulation in turbulent Rayleigh-Bénard convection. *J. Fluid Mech.* **607**, 119-139 (2008).
16. E. Brown, D. Funfschilling, G. Ahlers. Anomalous Reynolds-number scaling in turbulent Rayleigh-Bénard convection. *J. Stat. Mech.* P10005 (2007).
17. E. Brown, G. Ahlers. Temperature gradients and search for non-Boussinesq effects in the interior of turbulent Rayleigh-Bénard convection. *Europhysics Letters* **80**, 14001-1-6 (2007).
18. E. Brown, G. Ahlers. Large-scale circulation model for turbulent Rayleigh-Bénard convection. *Phys. Rev. Lett.* **98**, 134501-1-4 (2007).
19. E. Brown, G. Ahlers. Effect of the Earth's Coriolis force on the large-scale circulation of turbulent Rayleigh-Bénard convection. *Phys. Fluids* **18**, 125108-1-15 (2006).
20. G. Ahlers, E. Brown, F. Fontenele-Araujo, D. Funfschilling, S. Grossman, D. Lohse. Non-Oberbeck-Boussinesq effects in strongly turbulent Rayleigh-Bénard convection. *J. Fluid Mech.* **569**, 409-445 (2006).
21. E. Brown, G. Ahlers. Rotations and cessations of the large-scale circulation in turbulent Rayleigh-Bénard convection. *J. Fluid Mech.* **568**, 351-386 (2006).
22. G. Ahlers, E. Brown, A. Nikolaenko. The search for slow transients, and the effect of imperfect vertical alignment, in turbulent Rayleigh-Bénard convection. *J. Fluid Mech.* **557**, 347-367 (2006).

23. E. Brown, A. Nikolaenko, G. Ahlers. Reorientation of the large-scale circulation in turbulent Rayleigh-Bénard convection. *Phys. Rev. Lett.* **95** 084503-1–4 (2005).
24. E. Brown, A. Nikolaenko, D. Funfschilling, G. Ahlers. Heat transport in turbulent Rayleigh-Bénard convection: Effect of finite top- and bottom-plate conductivity. *Phys. Fluids* **17**, 075108-1–10 (2005).
25. D. Funfschilling, E. Brown, A. Nikolaenko, G. Ahlers. Heat transport by turbulent Rayleigh-Bénard Convection in cylindrical samples with aspect ratio one and larger. *J. Fluid Mech.* **536**, 145–154 (2005).
26. A. Nikolaenko, E. Brown, D. Funfschilling, G. Ahlers. Heat transport by turbulent Rayleigh-Bénard Convection in cylindrical cells with aspect ratio one and less. *J. Fluid Mech.* **523**, 251–260 (2005).

Invited Talks

1. Organized flow structures in turbulence. *California State University, Sacramento, colloquium*, Sacramento, CA (3/2012).
2. Strain-stiffening in random packings of entangled granular chains. *American Physical Society March Meeting*, Boston, MA (3/2012)
3. A dynamical model of the large-scale circulation in turbulent Rayleigh-benard convection. *Kavli Institute for Theoretical Physics: Nature of Turbulence workshop*, Santa Barbara, CA (3/2011).
4. Dilation and capillary forces in dense shear thickening suspensions. *Society of Rheology*, Santa Fe, NM (10/2010).
5. Shear thickening, jamming and dilation in suspensions. *Gordon Conference on Granular & Granular-Fluid Flow*, Waterville, MA (6/2010).
6. Dilation and the stress regime of shear thickening in dense suspensions *Jamming and rheology workshop*, Cargese, France (4/2010).
7. Oscillations of the large-scale circulation in turbulent Rayleigh-Bénard convection. *High Rayleigh Number Convection Workshop*, Les Houches, France (1/2010).
8. Dynamics of the large-scale circulation in turbulent Rayleigh-Bénard convection. *Chaos/Xaoc*, Woods Hole, MA (7/2009).
9. Spontaneous flow reorientations in turbulent thermal convection. *American Geophysical Union Fall meeting*, San Francisco, CA (12/2007).

Linda S Hirst

University of California, Merced
Physics
Office Phone: (209) 228-4569
Department Phone: (209) 228-4309
Fax: (209) 228-4053
Email: lhirst@ucmerced.edu
Website: <http://faculty.ucmerced.edu/lhirst>

Research Interests

Prof. Hirst's research interests focus on soft condensed matter physics, with interests in both biophysics and liquid crystal materials. In general, her research group uses experimental techniques to characterize molecular assemblies and to understand the physics behind why they form. Placing the work in a wider context, the group tries to uncover the common principles of how self-organization at a molecular level can transfer physical properties across length scales to define complex structures in real biological systems and soft phases.

The group uses a wide variety of experimental techniques, including x-ray diffraction and scattering, microscopy/imaging (Confocal microscopy, Atomic Force Microscopy (AFM) and Transmission Electron Microscopy (TEM)) and calorimetry.

Current research projects include:

1. The influence of cholesterol and polyunsaturated lipids on cell membrane structure. Phase behavior of lipids in the cell membrane and lipid raft formation. Synchrotron x-ray diffraction and small-angle scattering on model membrane systems. AFM and confocal fluorescence microscopy of giant vesicles and supported bilayers. Controlling Lipid phase behavior and raft formation for "soft microfluidics".
2. Biopolymer Networks, self-assembly of biopolymers into network architectures. Molecular Dynamics simulation of semi-flexible filaments in solution.
3. Development and characterization of new liquid crystal materials, including ferroelectric, and bent-core liquid crystal materials. Structural studies of novel phase morphologies and electro-optical characteristics.

In addition to her research interests Prof. Hirst is also the creator of softmatterworld.org, an educational/networking web-site for the soft matter community around the world.

Education

PhD, University of Manchester, 2001.

Major: Physics

Dissertation Title: An X-ray and electro-optic study of the liquid crystal smectic C* sub-phases.

Advisor: Gleeson, H. F.

BS, *1st Class Hons (highest UK classification)*, University of Manchester, 1997.

Major: Physics with Astrophysics

Professional Positions

Associate Professor, Physics, University of California, Merced (2011-2012).

Assistant Professor, Physics, University of California, Merced (2008-2011).

Assistant Professor, Florida State University. (2005 - 2008).

Department of Physics

Postdoctoral Researcher, University of California, Santa Barbara. (2002 - 2005).

Materials Department

Postdoctoral Researcher, Manchester University. (2001 - 2002).

Department of Physics and Astronomy

Undergraduate laboratory instructor, Manchester University. (1999 - 2001).

Professional Memberships

The Materials Research Society. (2008 - Present).

The Biophysical Society. (2003 - Present).

The American Physical Society. (2002 - Present).

The International Liquid Crystal Society. (1999 - Present).

Awards and Honors

National Science Foundation Early Career Award, Biomaterials, Division of Materials Research. (February 2008 - January 2013).

Awarded by the division of Bio-materials "CAREER: Self-assembly of polyunsaturated lipids and Cholesterol in the cell membrane".

The Glenn H. Brown Prize, International Liquid Crystal Society. (July 2004).

For "X-ray and resonant x-ray measurements of smectic C* sub-phases in a liquid crystal device".

This Prize is awarded every two years by the International Liquid Crystal Society for outstanding doctoral research in the field of liquid crystals.

RESEARCH

Intellectual Contributions

Book Chapters

Hirst, L. S. "Lipid Self Assembly" and "Biomaterials" in "The handbook of Liquid Crystals". In H. Gleeson (Ed.), Wiley. Publisher - Wiley. (Current Status: Submitted; Date Submitted - June 22, 2012). Author.

Books

Hirst, L. S. *Fundamentals of Soft Matter Science*. Taylor & Francis. Publisher - Taylor & Francis. (Current Status: Revising to Resubmit; Date Re-Submitted- March 2012, Date Submitted - May 31, 2011).

Conference/Workshop/Symposium Proceedings

Rodarte, A., Ferri, C. G.L., Grey, C., **Hirst, L. S.**, **Ghosh, S.** (2012). Directed assembly and in-situ manipulation of semiconductor quantum dots in liquid crystal matrices. In *proceedings of SPIE. Photonics West*, Vol. EMERGING LIQUID CRYSTAL TECHNOLOGIES VII, (pp. 8279H). (Current Status: Published; Date Published - March 2012). PI - Co-wrote paper.

Pinon, T. M., **Hirst, L. S.**, **Sharping, J. E.** (2011). Fiber based dual beam optical trapping system for studying lipid vesicle mechanics. In *Optical Trapping applications: OSA technical digest. Optical Society of America*, (pp. OTTuB2). USA. Optical Society of America. Publisher - Optical Society of America. (Current Status: Published; Date Published - 2011). Carried out research and wrote paper.

Wang, C., **Hirst, L. S.**, **Winston, R.** (2011). Optical design and efficiency improvement for organic luminescent solar concentrators. In *Proceedings of SPIE. SPIE*, Vol. 8124, USA. (Current Status: Published; Date Published - September 22, 2011).

Hirst, L. S., Kirchoff, J., Inman, R., **Ghosh, S.** (2010). Quantum dot self-assembly in liquid crystal media. In *Proceedings of the SPIE - The International Society for Optical Engineering. Emerging Liquid Crystal Technologies V*, Vol. 7618, (pp. 76180F (7pp.)). USA. SPIE - The International Society for Optical Engineering. Publisher - SPIE - The International Society for Optical Engineering. ISSN: 0277-786X. (Current Status: Published; Date Published - February 2010). PI, wrote paper and presented at conference.

Yuan, J., **Hirst, L. S.** (2009). Light induced Liquid Crystalline Phases in the Lipid Bilayer. In *Mol. Cryst. Liq. Cryst.. International Liquid Crystal Conference*, Vol. 8, (pp. 67-76). (Current Status: Published; Date Published - September 11, 2009). PI - Wrote paper and presented at conference..

Journal Articles

- Rodarte, A., Shcherbatyuk, G., Shcherbatyuk, L., **Hirst, L. S., Ghosh, S.** Dynamics of spontaneous emission of quantum dots in a one-dimensional cholesteric liquid crystal photonic cavity. *RSC Advance*. Publisher - Royal Society of Chemistry. (Current Status: Submitted; Date Submitted - June 2012). Carried out research and wrote paper.
- Pinon, T., Castelli, A., **Hirst, L. S., Sharping, J. E.** Dual-beam fiber optical trapping system for lipid vesicle deformation. *Optics Express*. Publisher - Optics Express. (Current Status: Submitted; Date Submitted - June 19, 2012). carried out research and wrote paper.
- Rodarte, A., Grey, C., **Hirst, L. S., Ghosh, S.** (2012). Spectral and polarization modulation of quantum dot emission in a one-dimensional liquid crystal photonic cavity. *Physical Review B*, 85. Publisher - Physical Review B. (Current Status: Published; Date Published - January 2012). carried out research and wrote paper.
- Hirst, L. S.**, Uppamoochikkal, P., Lor, C. (2011). Phase separation and critical phenomena in biomimetic ternary lipid mixtures. *Liquid Crystals*, 38(11-12), 1735-1747. Publisher - Liquid Crystals. (Current Status: Published; Date Published - December 2011). Co-Wrote paper.
- Cheng, Y., Chen, K.-S., Meyer, N., Yuan, J., **Hirst, L. S.**, Chase, P.B., Xiong, P. (2011). Functionalized SnO₂ nanobelt field effect transistor sensors for label-free detection of cardiac troponin. *BIOSENSORS AND BIOELECTRONICS*, 26, 4538-4544. Publisher - Elsevier. (Current Status: Published; Date Published - June 21, 2011). carried out research.
- Nguyen, L. T., **Hirst, L. S.** (2011). Polymorphism of highly cross-linked F-actin networks: probing multiple lengthscales. *Physical Review E*, 83, 031910. Publisher - American Physical society. (Current Status: Published; Date Published - March 2011). PI - analyzed data and wrote paper..
- Kirchhoff, J., **Hirst, L. S.** (2011). Steric stabilization of the ferroelectric intermediate liquid crystal phase by dopant induced conformational change. *Liquid crystals*, 38(3), 255-261. Publisher - Taylor and Francis. (Current Status: Published; Date Published - March 2011) (Article featured as cover art). PI - carried out research and wrote paper.
- Verma, Y. K., Inman, R. H., Ferri, C. G.L., Mirafzal, H., Ghosh, S. N., **Kelley, D. F., Hirst, L. S., Chin, W.-C., Ghosh, S.** (2010). Electrical modulation of static and dynamic spectroscopic properties of coupled GaSe quantum dot nano-assemblies. *Physical Review B*. Publisher - Physical Review B. (Current Status: Published; Date Published - October 15, 2010, Date Accepted - September 21, 2010, Date Submitted - June 7, 2010). Carried out research.
- Tian, L., Zhong, K., Liu, Y., Huang, Z., Jin, L., **Hirst, L. S.** (2010). Synthesis and self-assembly of coil-rod-coil molecules with lateral methyl and ethyl groups in the center of the rod segment. *Soft Matter*, 6(23), 5993-5998. Publisher - Soft Matter. (Current Status: Published; Date Published - September 24, 2010, Date Accepted - August 25, 2010). Co-wrote paper.
- Kirchhoff, J., **Hirst, L. S.** (2010). Modification of the electro-optical properties of the B1 liquid crystal phase using a rod-like liquid crystal dopant. *Physical Review E*, 82, 031701-7. Publisher - APS. (Current Status: Published; Date Published - September 10, 2010). PI - carried out research and co-wrote paper.
- Chen, L., Zhong, K., Jin, L., Huang, Z., Liu, L., **Hirst, L. S.** (2010). Supramolecular honeycomb and columnar assemblies formed by self-assembly of coil-rod-coil molecules

- with a conjugated rod segment. *Macromolecular research*, 18(8), 800-805. Publisher - Springer. (Current Status: Published; Date Published - August 2010). Co-wrote paper.
- Hirst, L. S.**, Yuan, J. (2009). The effects of fluorescent probes on model membrane organization: photo-induced lipid sorting and soft structure formation. *Liquid Crystals*, 36(6-7), 739-745. Publisher - TAYLOR & FRANCIS LTD. ISSN: 0267-8292. (Current Status: Published; Date Published - June 2009). PI - Carried out research, wrote paper.
- Yuan, J., Kiss, A., Pramudya, Y.H., Nguyen, L.T., **Hirst, L. S.** (2009). Solution synchrotron x-ray diffraction reveals structural details of lipid domains in ternary mixtures. *Physical Review E (Statistical, Nonlinear, and Soft Matter Physics)*, 79(3), 031924 (9 pp.). Publisher - American Physical Society. ISSN: 1539-3755. (Current Status: Published; Date Published - March 2009). PI - carried out research, wrote paper.
- Nguyen, L.T., Yang, W., Wang, Q., **Hirst, L. S.** (2009). Molecular dynamics simulation of F-actin reveals the role of cross-linkers in semi-flexible filament assembly. *Soft Matter*, 5, 2033-2036. Publisher - The Royal Society of Chemistry. DOI: 10.1039/b817927a. (Current Status: Published; Date Published - March 26, 2009, Date Accepted - January 7, 2009, Date Submitted - October 14, 2008). PI - carried out research, co-wrote paper. [Full text of this item is available](#)
- Yuan, J., Hira, S., Strouse, G., **Hirst, L. S.** (2008). Lipid Bilayer Discs and Banded Tubules: Photo-induced Lipid Sorting in Ternary Mixtures. *J. Am. Chem. Soc.*, 130(6), 2067. Publisher - ACS. 10.1021/ja710305c. (Current Status: Published; Date Published - January 23, 2008). PI - carried out research, wrote paper.
- Yuan, J., Parker, E. R., **Hirst, L. S.** (2007). Cationic Lipid Absorption on Titanium: A Counter-ion Mediated Bilayer to Lipid-Tubule-Network Transition. *LANGMUIR*, 23(14), 7462-7465. Publisher - LANGMUIR. (Current Status: Published; Date Published - 2007). PI - carried out research, wrote paper.
- Kirchhoff, J., **Hirst, L. S.** (2007). Investigation into liquid crystalline smectic-C* subphase stability using chiral and achiral dopants. *Physical Review E (Statistical, Nonlinear, and Soft Matter Physics)*, 76(5), 051704-1-6. Publisher - American Physical Society through AIP. ISSN: 1539-3755. (Current Status: Published; Date Published - November 2007). PI - carried out research, co-wrote paper.
- Kirchhoff, J., **Hirst, L. S.**, Fergusson, K.M., Hird, M. (2007). Low electric-field-induced switching in the B1 bent-core liquid crystal phase. *Applied Physics Letters*, 90(16), 161905-1-3. Publisher - AIP. ISSN: 0003-6951. (Current Status: Published; Date Published - April 16, 2007). PI - carried out research and wrote paper.
- Jaradat, S., Roberts, N.W., Wang, Y., **Hirst, L. S.**, Gleeson, H.F. (2006). Remarkably wide four-layer smectic phases in mixtures of liquid crystals and highly chiral dopants. *JOURNAL OF MATERIALS CHEMISTRY*, 16(38), 3753-3761. Publisher - ROYAL SOC CHEMISTRY,. ISSN: 0959-9428. (Current Status: Published; Date Published - 2006). Carried out research and collaborated on project.
- Gleeson, H.F., **Hirst, L. S.** (2006). Resonant X-ray scattering: A tool for structure elucidation in liquid crystals. *CHEMPHYSICHEM*, 7(2), 321-328. Publisher - WILEY-VCH VERLAG GMBH. ISSN: 1439-4235. (Current Status: Published; Date Published - February 13, 2006). Carried out research, co-wrote paper.
- Roberts, N.W., Jaradat, S., **Hirst, L. S.**, Thurlow, M.S., Wang, Y., Wang, S.T., Lui, Z.Q., Huang, C.C., Bai, J., Pindak, R., Gleeson, H.F. (2005). Biaxiality and temperature dependence of 3- and 4-layer intermediate smectic-phase structures as revealed by resonant X-ray scattering. *EUROPHYSICS LETTERS*, 72(6), 976-982. Publisher - EDP SCIENCES S A. ISSN: 0295-5075. (Current Status: Published; Date Published - December 2005). Carried out research and collaborated on project.

- Hirst, L. S.**, Parker, E., Abu Samah, Z., Li, Y., Pynn, R., MacDonald, N.C., Safinya, C.R. (2005). Microchannel systems in titanium and silicon for structural and mechanical studies of aligned protein self-assemblies. *LANGMUIR*, 21(9), 3910-3914. Publisher - LANGMUIR. (Current Status: Published; Date Published - 2005). Carried out research and wrote paper.
- Hirst, L. S.**, Pynn, R., Bruinsma, R.F., Safinya, C.R. (2005). Hierarchical self-assembly of actin bundle networks: Gels with surface protein skin layers. *JOURNAL OF CHEMICAL PHYSICS*, 123(10), 104902. Publisher - AMER INST PHYSICS. ISSN: 0021-9606. (Current Status: Published; Date Published - September 8, 2005). Carried out research and wrote the paper.
- Hirst, L. S.** (2004). Resonant Scattering from Liquid Crystal Devices: An in-situ Structural Probe for the Smectic Phases. *Liquid Crystals Today*. Publisher - Liquid Crystals Today. (Current Status: Published; Date Published - December 2004).
- Bouxein, N.F., **Hirst, L. S.**, Li, Y.L., Safinya, C.R., Abu Samah, Z., MacDonald, N.C., Pynn, R. (2004). Alignment of filamentous proteins and associated molecules through confinement in microchannels. *APPLIED PHYSICS LETTERS*, 85(23), 5775-5777. Publisher - AMER INST PHYSICS. ISSN: 0003-6951. (Current Status: Published; Date Published - December 6, 2004). carried out research, wrote paper.
- Hirst, L. S.**, Safinya, C.R. (2004). Skin Layer at the actin-gel surface: quenched protein membranes form flat, crumpled, and tubular morphologies. *Physical Review Letters*, 93(1), 018101/1-4. Publisher - APS. ISSN: 0031-9007. (Current Status: Published; Date Published - July 2, 2004). Carried out research, wrote paper.
- Pelletier, O., Pokidysheva, E., **Hirst, L. S.**, Bouxein, N., Li, Y., Safinya, C.R. (2003). Structure of actin cross-linked with α -actinin: a network of bundles. *Physical Review Letters*, 91(14), 148102/1-4. Publisher - APS. ISSN: 0031-9007. (Current Status: Published; Date Published - October 3, 2003) ((Featured on the Cover of PRL and as and SSRN Science highlight)). carried out research, co-wrote paper.
- Watson, S.J., Baylis, L.J., **Hirst, L. S.**, Bowring, N., Gleeson, H.F. (2002). The Influence of Electric Fields on the Layer Structure of Antiferroelectric Liquid Crystal Devices. *Physical Review E*, 65(3). Publisher - American Institute of Physics. art. no. 031702. (Current Status: Published; Date Published - 2002). aka L. S. Matkin carried out research.
- Hirst, L. S.**, Watson, S.J., Gleeson, H.F., Cluzeau, P., Barois, P., Pindak, R., Pitney, J., Cady, A., Johnson, P.M., Huang, C.C., Levelut, A.-M., Srajer, G., Pollmann, J., Caliebe, W., Seed, A., Herbert, M.R., Goodby, J.W., Hird, M. (2002). Interlayer structures of the chiral smectic liquid crystal phases revealed by resonant X-ray scattering. *Physical Review E (Statistical, Nonlinear, and Soft Matter Physics)*, 65(4), 041705/1-10. Publisher - APS through AIP. ISSN: 1063-651X. (Current Status: Published; Date Published - April 2002). carried out research, wrote paper.
- Cady, A., Pitney, J., Pindak, R., **Hirst, L. S.**, Watson, S.J., Gleeson, H.F., Cluzeau, P., Barois, P., Levelut, A.-M., Caliebe, W., Goodby, J.W., Hird, M., Huang, C.C. (2001). Orientational ordering in the chiral smectic-CF12* liquid crystal phase determined by resonant polarized x-ray diffraction. *Physical Review E*, 64. Publisher - APS through AIP. DOI: 10.1103/PhysRevE.64.050702. (Current Status: Published; Date Published - October 18, 2001, Date Submitted - July 13, 2001). L.S. Matkin carried out research.
- Hirst, L. S.**, Watson, S. J., Gleeson, H. F., Pindak, R., Pitney, J. A., Barois, P., Levelut, A.-M., Srajer, G., Pollmann, J. (2001). A resonant x-ray scattering study of the antiferroelectric and ferroelectric phases in a liquid crystal device. *Physical Review E*, 64(2), 1705. Publisher - APS. (Current Status: Published; Date Published - August 2001). Carried out research, wrote paper

aka Matkin.

Hirst, L. S., Gleeson, H.F., Baylis, L.J., Watson, S.J., Bowring, N., Seed, A., Hird, M., Goodby, J.W. (2000). Electric field-induced layer deformations in the subphases of an antiferroelectric liquid crystal device. *Applied Physics Letters*, 77(340). Publisher - American Institute of Physics. doi:10.1063/1.126970. (Current Status: Published; Date Published - 2000, Date Accepted - May 22, 2000, Date Submitted - April 5, 2000). aka L. S. Matkin

Carried out research, wrote paper.

Hirst, L. S., Gleeson, H.F., Mach, P., Huang, C.C., Pindak, R., Srajer, G., Pollmann, J., Goodby, J. W., Hird, M., Seed, A. (2000). Resonant Scattering at the Se Edge in Liquid Crystal Free-standing Films and Devices. *Applied Physics Letters*, 76(14). Publisher - Applied Physics Letters. (Current Status: Published; Date Published - April 3, 2000). aka L.S. Matkin

carried out research, wrote paper.

Presentations Given

- Hirst, L. S., "Deforming Lipid Bilayers: Molecular Tilt, Optical Forces and Oxidation," UC Riverside Dept of Materials Science and Engineering, UC Riverside. Departmental colloquium. (February 2012).
- Hirst, L. S., The 23rd International Liquid Crystal Conference, "Tilt induced crumpling in 'smectic' like lipid shells," The International Liquid Crystal Society, Krakow, Poland. (July 2010).
- Hirst, L. S., Colloquium, Kent State University, LCI Institute, Kent, OH. (April 2010).
- Hirst, L. S., UC Solar Meeting, "Quantum dot dispersion and assembly in liquid crystal media for Solar Applications," UC Berkeley, UC Berkeley. (April 2010).
- Hirst, L. S., Biophysical Society Annual Meeting, "Hierarchical cross-linked actin networks: Understanding Structure and Assembly," Biophysical Society, San Francisco. (February 2010).
- Hirst, L. S., Dept of Biological Sciences, Seminar, University of Bristol, Bristol, UK. (January 2010).
- Hirst, L. S., Photonics West Symposia 2010, Emerging Liquid Crystal Technologies V, "Quantum dot self-assembly in liquid crystal media," SPIE, San Francisco. (January 2010).
- Hirst, L. S., Physics Dept. Seminar, soft matter group, Edinburgh University, Edinburgh, UK. (January 2010).
- Hirst, L. S., American Physical Society annual meeting, California section, "Investigating the assembly of actin networks," Monterey. (November 2009).
- Hirst, L. S., Physics Colloquium, "Self-assembly of soft systems: research at UC Merced," Sacramento State University, CA, Sacramento. (November 2009).
- Hirst, L. S., Materials Research Society Spring Meeting, "Ultra-soft microfluidics: photoinduced structures from lipid bilayers," Materials Research Society, San Francisco. (March 2009).
- Hirst, L. S., Materials Science and Engineering Colloquium, "Self-assembly in biomaterials: designing soft structures," UCSB, Dept of Materials Science and Engineering - Hosted by N.A. Spaldin, Santa Barbara. (November 2008).
- Hirst, L. S., Physics Colloquium, "Self-assembly in biomaterials: designing soft structures," Cal Poly San Luis Obispo - Hosted by K. Sanders, San Luis Obispo. (November 2008).
- Hirst, L. S., Physics Colloquium, "Self-assembly in biomaterials: designing soft structures," University of Pennsylvania - Hosted by R. Kamien, Philadelphia. (October 2008).
- Hirst, L. S., "Self-assembly in biomaterials: designing soft structures," HP Labs - Hosted by: S. Klein, Palo Alto, CA. (September 2008).
- Hirst, L. S., I2CAM Workshop on Light Induced effects in Liquid Crystals, "Self-assembly in biomaterials: designing soft structures," I2CAM Workshop on Light Induced effects in Liquid Crystals, Boulder, CO. (August 2008).
- Hirst, L. S., The 22nd International Liquid Crystal Conference, "Phase separation in lipid bilayers," The International Liquid Crystal Society, Jeju, South Korea. (July 2008).
- Hirst, L. S., Physics Dept. Colloquium, "Liquid Crystalline Phases in the Lipid Bilayer," Kent State University- Hosted by R. Selinger, Ohio. (March 2008).

- Hirst, L. S., Seminar - Case Western Reserve University Physics Dept., "Liquid Crystalline Phases in the Lipid Bilayer," Cleveland, OH. (March 2008).
- Hirst, L. S., Dept. of Biochemical Engineering, "Liquid Crystalline Phases in the Lipid Bilayer," Florida State University, Tallahassee, FL. (February 2008).
- Hirst, L. S., School of Natural Sciences, University of California at Merced, Merced, CA. (January 2008).
- Hirst, L. S., Physics Colloquium, "Manipulating liquid crystalline phases in the lipid bilayer," University of Victoria - Hosted by G. Steeves, Victoria, Canada. (November 2007).
- Hirst, L. S., Physics Colloquium, "Liquid Crystalline Phases in the Lipid Bilayer," University of South Florida - Hosted by S. Pandit, Tampa, FL. (September 2007).
- Hirst, L. S., National Synchrotron Light Source Seminar, "Liquid Crystalline Phases in the Lipid Bilayer," Brookhaven National Laboratory, New York. (August 2007).
- Hirst, L. S., Liquid Crystal Gordon Conference, "Liquid Crystalline Phases in Lipid Bilayers and Tubules," Tilton, NH. (June 2007).
- Hirst, L. S., American Physical Society March Meeting, "Polyunsaturated fatty acids in the lipid bilayer," American Physical Society, Denver, CO. (March 2007).
- Hirst, L. S., Seminar - Dept. of Mathematics, Florida State University - Host Qi Wang, Tallahassee, FL. (April 2006).
- Hirst, L. S., Seminar series, "Filamentous protein aslf-assembly: alignment and structural studies on different lengthscales," National High Magnetic Field Laboratory, Tallahassee, FL. (October 2005).
- Hirst, L. S., Institute of Molecular Biophysics, "Self-assembly and the actin cytoskeleton," Florida State University, Tallahassee, FL. (September 2005).
- Hirst, L. S., The 20th International Liquid Crystal Conference, "X-ray Studies of the SmC* Sub-phases in Free-standing and Device Geometries," Ljubljana, Slovenia. Glenn H. Brown Price Invited Talk. (July 2004).
- Hirst, L. S., The American Physical Society, "Filamentous Actin Skin-layer Membranes with Novel Morphologies," Montreal, Canada. (March 2004).

Contracts, Grants and Sponsored Research

Grant

- Hirst, Linda S (Co-Principal Investigator), Winston, Roland (Co-Principal Investigator), Abengoa Solar.
- Hirst, Linda S, "UC Merced Mathematics and Physical science Scholars (MAPS)," NSF - National Science Foundation. (2011 - 2015).
- Hirst, Linda S (Co-Principal Investigator), Ghosh, Sayantani (Co-Principal Investigator), "Thermally directed assembly of metallic nanostructures in liquid crystal matrices for switchable plasmonic waveguides," UC Merced graduate research council. (March 2012 - February 2013).
- Hirst, Linda S (Principal Investigator), "Career: Self-Assembly of Polyunsaturated Lipids and Cholesterol In The Cell Membrane," NSF - National Science Foundation, \$575,000.00. (February 2008 - February 2013).
- Hirst, Linda S (Principal Investigator), Ghosh, Sayantani (Co-Principal Investigator), "Graduate Research Council research award," UC Merced Graduate Research Council Faculty Research Grant, \$10,000.00. (2011 - 2012).
- Hirst, Linda S (Principal Investigator), Winston, Roland (Principal Investigator), "Liquid crystal film enhanced solar concentrators," Abengoa Solar, \$14,715.00. (February 2011 - December 2011).
- Hirst, Linda S (Principal Investigator), Chin, Wei-Chun (Co-Principal Investigator), Escobar, Ariel Luis Manuel (Co-Principal Investigator), "Graduate Research Council research award," UC Merced Graduate Research Council Faculty Research Grant, \$9,000.00. (2009 - 2010).
- Hirst, Linda S (Principal Investigator), "Seed funding for "softmatterworld.org"," International Center for Materials Research (ICMR, through NSF), \$2,000.00. (2007 - 2008).
- Hirst, Linda S (Principal Investigator), "Small Grant Program," Florida State University Council for Research Creativity, \$3,000.00. (2007).
- Hirst, Linda S (Principal Investigator), "Equipment and Infrastructure Enhancement Grant: A Small Angle X-ray Scattering Spectrometer for Biophysical and Soft Matter Research," Florida State University Research Foundation, \$33,000.00. (2006 - 2007).

Hirst, Linda S (Principal Investigator), "Planning Grant:Bent Core liquid Crystals," Florida State University Council for Research Creativity, \$12,000.00. (2006 - 2007).

Hirst, Linda S (Principal Investigator), Roberts, Nick (Co-Principal Investigator), "The British Council, UK, Research Exchange Grant: Bio-physical properties of photoreceptor cells in the retina," University of Manchester, UK, \$10,000.00. (2006 - 2007).

Hirst, Linda S (Principal Investigator), "First Year Assist Prof. Award," Florida State University Council for Research Creativity, \$15,000.00. (2005).

Subcontract

Hirst, Linda S (Principal Investigator), "IMI:International Center for Materials Science (ICMS)," NSF - National Science Foundation, \$100,000.00. (August 2009 - August 2014).

Intellectual Property

Hirst, L. S., Sharping, J. E., Pinon, T., Patent, "Simple and inexpensive optical fiber based light force particle trapping and microfluidic system", Provisional, United States.

Professional Service

NSF ad hoc reviewer, Ad Hoc Reviewer, Appointed, Pro Bono, National. (September 2005 - Present).

Multiple scholarly journals, Ad Hoc Reviewer, Appointed, Pro Bono, International. (2005 - Present).

NSF Review Panel: DMR, Extramural Funding Reviewer, Appointed, Pro Bono, International, Reviewing proposals In panel format at NSF in Washington dc.. (2008 - 2012).

Biophysical Society annual meeting, Session chair, San Fransisco, CA, USA, Appointed, Pro Bono, International. (February 2010).

SPIE Photonics West, Emerging Liquid Crystal Technologies V, Session chair, San Fransisco, CA, USA, Appointed, Pro Bono, International. (January 2010).

Liquid Crystal Gordon Conference 2009, Session chair/ Disussion leader, NH, USA, Appointed, Pro Bono, International. (July 2009).

International Liquid Crystal Conference, Reviewer, Appointed, Pro Bono, International, Reviewed four papers for the 2008 ILCCproceedings published in Molecular Crystals and Liquid Crystals.. (2008).

International Liquid Crystal Conference, Session chair, Jeju, Republic of Korea, Appointed, Pro Bono, International. (July 2008).

TEACHING

Teaching Experience

University of California, Merced

Spring, 2012

BEST 295, Graduate Research. (Spring 2012)
PHYS 108, Thermal Physics Core. (Spring 2012)
PHYS 195, Upper Division Undergraduate Research. (Spring 2012)
PHYS 196, Undergraduate Thesis. (Spring 2012)
PHYS 295, Graduate Research. (Spring 2012)

Fall, 2011

PHYS 141, Condensed Matter Physics. (Fall 2011)
PHYS 195, Upper Division Undergraduate Research. (Fall 2011)
PHYS 241, Condensed Matter Physics. (Fall 2011)
PHYS 295, Graduate Research. (Fall 2011)
QSB 299, Directed Independent Study. (Fall 2011)

Spring, 2011

BEST 295, Graduate Research. (Spring 2011)
PHYS 108, Thermal Physics Core. (Spring 2011)
PHYS 195, Upper Division Undergraduate Research. (Spring 2011)
PHYS 295, Graduate Research. (Spring 2011)
PHYS 95, Lower Division Undergraduate Research. (Spring 2011)

Fall, 2010

BEST 295, Graduate Research. (Fall 2010)
PHYS 195, Upper Division Undergraduate Research. (Fall 2010)
PHYS 295, Graduate Research. (Fall 2010)
PHYS 8, Introductory Physics I. (Fall 2010)

Summer, 2010

PHYS 195, Upper Div Undergrad Research. (Summer 2010)

Spring, 2010

BIO 195, Upper Div Undergrad Research. (Spring 2010)
PHYS 141, Condensed Matter Physics. (Spring 2010)
PHYS 195, Biophysics Research. (Spring 2010)
PHYS 241, Condensed Matter Physics. (Spring 2010)
PHYS 295, Biophysics Research. (Spring 2010)
PHYS 299, Condensed Matter. (Spring 2010)

Fall, 2009

PHYS 195, Biophysics Research. (Fall 2009)

PHYS 8, Introductory Physics I. (Fall 2009)

Spring, 2009

BIO 195, Biophysics. (Spring 2009)

BIOE 95, Biophysics Research. (Spring 2009)

PHYS 295, Graduate Research. (Spring 2009)

PHYS 8, Introductory Physics I. (Spring 2009)

Fall, 2008

BIS 195, Upper Div Undergrad Research. (Fall 2008)

PHYS 295, Biophysics Research. (Fall 2008)

Other Courses Taught

General Physics A - Florida State University. (Fall 2005)

College Physics A - Florida State University. (Fall 2006)

General Physics B - Florida State University. (Spring 2006)

General Physics A - Florida State University. (Fall 2007)

College Physics B - Florida State University. (Spring 2007)

Principles of Condensed Matter Physics - Florida State University. (Spring 2008)

Other

Guest Lecture, (April 2012).

Lecture to NSED 99 class on careers in physics

Workshop, (August 23, 2011).

Member of the faculty panel in a session on success strategies for transfer students at UC Merced

Guest Lecture, (July 2011).

Research lecture to undergraduate participants in the summer internship program

Guest Lecture, (July 2011).

Research lecture to undergraduates in the internship program

Doctoral Candidacy Committee

David Ando, Chair

September 2009 - Present, Tessa Pinon, Supervisor Joint supervisor with Prof. J. Sharping

September 2009 - June 2012, georgiy shcherbatyuk, Member

September 2008 - July 2010, Igor Goncharenko, Chair

September 2005 - April 2010, Jennifer Kirchhoff, Supervisor

2006 - 2008, Nancy Meyer, Member

2007, Volkan Sevim, Member

2006, Ibrahim Abu Hamad, Member

Doctoral Committee

Azade Petrovski, Member

December 2011 - Present, Zachary Nuno, Supervisor

July 2010 - Present, Chai Lor, Supervisor

January 2010 - Present, Andrea Rodarte, Supervisor Joint supervisor with Prof. S. Ghosh

January 2010 - Present, Ron Pandolfi, Supervisor

2011, Eric Chen, Member

September 2005 - March 2011, Lam Nguyen, Supervisor

September 2009 - August 2010, Mark Kerfoot, Supervisor Mark is continuing his graduate work with Michael Scheibner

2006 - June 2008, Marie Zabel Markarian, Member

September 2005 - August 2007, Yohanes Pramudya, Supervisor Yohanes was my graduate student for two years at Florida State University and is continuing his graduate studies with Prof. Dobrosavljevic at FSU

2006, Lara al Hariri, Member

Master's Thesis Committee

July 2011, Bernado Zepeda, Member

July 2011, Heather Orrell, Member

Postdoctoral Research Supervision

November 2010 - Present, Pradeep Uppamoochikkal, Supervisor

June 2009 - June 2010, Longyi Jin, Supervisor Longyi was sponsored by a Chinese fellowship to work with our group and is currently a professor at Yanbian University in China.

February 2006 - January 2009, Jing Yuan, Supervisor

Undergraduate Research Supervision

September 2011 - Present, Melissa Ricketts, Advisor This is a physics senior thesis project

July 2009 - Present, Matthew Fraser, Adam Ossowski, Ashley Ahrens, David Johnston, Lauren Edwards, Supervisor

July 2008 - June 2009, Chai Lor, Heather Orrell, David Larson, Supervisor

January 2006 - June 2008, Tyler Thomas, Alexander Kiss, Michael Uhler, Aaron Williams, Jordan Roberts, Supervisor

SERVICE

Department Service

Coordinator, Materials Research Group Seminar Co-ordinator at Florida State University. (December 2005 - June 2008).

Member, Graduate Affairs Committee, Physics Dept. Florida State University. (September 2005 - June 2008).

Member, Departmental Chair selection committee, Dept of Physics, Florida State University. (December 2006 - March 2007).

School/College Service

Chair, Physics graduate affairs committee. (August 2011 - Present).

Lead, Physics graduate program lead. (December 2009 - Present).

Chair, Physics Search committee (soft matter/biophysics). (October 2010 - July 2011).

Member, Physics Search Committee. (July 2009 - June 2010).

Chair, Biophysics Search Committee. (July 2008 - June 2009).

Member, Natural Science Website Design Committee. (July 2008 - June 2009).

University Service

Member, CRCC policy committee. (December 2011 - July 2015).

Member, Cancer Research Co-ordinating Committee (CRCC). (November 2009 - November 2013).

Member, Committee on Committees (COC). (May 2011 - June 2013).

COC representative, Divisional Council (DivCo). (July 2011 - January 2012).

Member, Academic Resources Planning Committee (ARPC). (September 2008 - 2010).

Member, School of Medicine planning committee. (2008 - 2009).

Chair, Physics Graduate Admissions Committee. (July 2008 - June 2009).

Public Service

Member, Saturday Morning Physics, Tallahassee, Fl. (September 2007 - June 2008).

Jing Xu, Ph.D.

Assistant Professor, School of Natural Sciences, UC Merced, CA 95343
jing.xu@ucmerced.edu

Education

2010 Protein Purification and Characterization Course, Cold Spring Harbor Laboratory
2001-2006 Ph.D., Physics/Biophysics, UC Santa Barbara
1994-1998 B.S. with Honor, Physics, Caltech

Research Experience

2006 - 2011 Postdoctoral Fellow, Development and Cell Biology, UC Irvine
2001 - 2006 Graduate Student Researcher, UC Santa Barbara
1998 - 2001 Staff Researcher, Physics, Caltech
1995 - 1998 Undergraduate Student Researcher, Physics, Caltech

Teaching Experience

08/2004 - 08/2005 NSF K-12 Teaching Fellow, Physics, Santa Barbara High School
03/2004 - 06/2004 Teaching Assistant, Physics, UC Santa Barbara
09/2001 - 03/2002 Teaching Assistant, Physics, UC Santa Barbara
06/1998 - 07/1998 Teaching Assistant, Mechanical Engineering, Summer Science Camp, Caltech

Outreach

2002 - 2005 Summer graduate Research Mentor, Physics, UC Santa Barbara
2002 - 2006 Physics Circus, Elementary School Outreach, UCSB
1997 - 1998 Volunteer Tutor, Pasadena Unified School District, Caltech

Fellowships and Awards

2008-2010 Postdoctoral Fellowship, American Heart Association
2010 Biophysical Society Committee for Professional Opportunities for Women Travel Award
2010 American Society for Cell Biology Postdoctoral Travel Award
2009 Dean's Award for Postdoctoral Research Excellence, UCI
2008 Barbara Burgess Memorial Postdoctoral Award, UCI
2005 Graduate Student Research Fellowship, NASA
2005 Graduate Opportunity Fellowship, UCSB
2004 NSF GK-12 Fellowship with Let's Explore Applied Physical Science (LEAPS), UCSB
2004 Mitsubishi Chemical Distinguished Graduate Fellowship, UCSB
2004 Broida-Hirschfelder Fellowship, UCSB
2004 Science and Engineering Research Grant, UCSB
2004 Doctoral Student Travel Grant, UCSB
1995 Summer Undergraduate Research Fellow, Physics, Caltech
1994 Advanced Placement Scholar, US College Board
1994 Summer Internship, the Space Science Laboratory, UC Berkeley

Publications

1. J. Xu^T, Z. Shu, S.J. King, S.P. Gross^T, " Tuning Multiple Motor Travel Via Single Motor Velocity", In Press
2. J. Xu, B.J.N. Reddy, P. Anand, Z. Shu, S. Cermelli, M.K. Mattson, S.K. Tripathy, M.T. Hoss, N.S. James, S.J. King, L. Bardwell, L. Huang, S.P. Gross, "Casein Kinase 2 Reverses Tail-Independent Inactivation of Kinesin-1", *Nature Communications*, 3, 754 (2012)
3. A. Kunwar, S.K. Tripathy, J. Xu, M.K. Mattson, P. Anand, R. Sigua, M. Vershinin, R.J. McKenney, C.C. Yu, A. Mogilner, S.P. Gross, "Mechanical stochastic tug-of-war models cannot explain bidirectional lipid-droplet transport", *PNAS*, 108, 18960 (2011)
4. J. Xu, S.P. Gross, "Biophysics of Dynein *In Vivo*" (invited review), *Dyneins: Structure, Biology and Disease*, (*Elsevier*), Editor Stephen M. King (2011)
5. J. Xu*, K.M. Ori-McKenney*, S.P. Gross, R.B. Vallee, "A Cytoplasmic Dynein Tail Mutation Impairs Motor Processivity", *Nat. Cell Biol.*, 12, 1228 (2010)

Referred to by: "Dynein at odd angles?", A.G. Hendricks, J.E. Lazarus, E.L.F. Holzbaur, *Nat. Cell Biol.*, 12, 1126 (2010)

6. G.T. Shubeita, S.L. Tran, J. Xu, M. Vershinin, S. Cermelli, S.L. Cotton, M.A. Welte, S.P. Gross, "Consequences of Motor Copy Number on the Intracellular Transport of Kinesin-1-Driven Lipid Droplets", *Cell*, 135, 1098 (2008)

Referred to by: "Counting Motors by Force", D.St. Johnston, *Cell*, 135, 1000 (2008)

7. K.S. Larsen, J. Xu, S. Cermelli, Z. Shu, S.P. Gross, "BicaudalD Actively Regulates Microtubule Motor Activity in Lipid Droplet Transport", *PLoS ONE*, 3, e3763 (2008)
8. Kunwar, M. Vershinin, J. Xu, S.P. Gross, "Stepping, Strain Gating, and an Unexpected Force-Velocity Curve for Multiple-Motor-Based Transport", *Curr. Biol.*, 18, 1173 (2008)
9. J. Xu*, M. Vershinin*, D.S. Razafsky, S.J. King, S.P. Gross, Tuning Microtubule-Based Transport Through Filamentous MAPs: The Problem of Dynein", *Traffic*, 9, 882 (2008).
10. J. Xu, K.W. Plaxco, S.J. Allen, J.E. Bjarnason, E.R. Brown, "0.15 - 3.72 Terahertz Absorption of Aqueous Salts and Saline Solutions", *Appl. Phys. Lett.*, 90, 031908 (2007)
11. J. Xu, S.J. Allen, K.W. Plaxco, "The Collective Dynamics of Lysozyme in Water: Terahertz Absorption Spectroscopy and Comparison with Theory", *J. Phys. Chem. B*, 110, 24255 (2006)
12. J. Xu, S.J. Allen, K.W. Plaxco, "Probing the Collective Vibrational Dynamics of a Protein in Liquid Water by Terahertz Absorption Spectroscopy", *Protein Sci.*, 15, 1175 (2006)
13. P. Robrish, J. Xu, S. Kobayashi, P.G. Savvidis, B. Kolasa, G. Lee, D. Mars, S.J. Allen, "Bloch Oscillating Super-Superlattices", *Proc. NGS 12*, VI, 01 (2006)
14. P. Robrish, J. Xu, S. Kobayashi, P.G. Savvidis, B. Kolasa, G. Lee, D. Mars, S.J. Allen, "Loss and Gain in Bloch Oscillating Super-Superlattices: THz Stark Ladder Spectroscopy", *Physica E*, 32, 325 (2006)
15. J. Xu, S.J. Allen, K.W. Plaxco, "Absorption Spectra of Liquid Water and Aqueous Buffers between 0.3 - 3.72 Terahertz", *J. Chem. Phys.*, 124: 036101 (2006)
16. H.A. Walling, E.G. Gwinn, J. Xu, K.D. Maranowski, A.C. Gossard, "Temperature Dependence of Conductance Fluctuations in Quantum Hall Multilayers", *Phys. Rev. B*, 70, 235343 (2004)
17. J. Xu, J.F. Galan, G.J. Ramian, P.G. Savvidis, A.M. Scopatz, R.R. Birge, S.J. Allen, K.W. Plaxco, "Terahertz Circular Dichroism of Biopolymers", *Proc. SPIE Int. Soc. Opt. Eng.*, 5268, 19 (2004)
18. J. Xu, G.J. Ramian, J.F. Galan, P.G. Savvidis, A.M. Scopatz, R.R. Birge, S.J. Allen, K.W. Plaxco, "Terahertz Circular Dichroism Spectroscopy: A Potential Approach to the *In Situ* Detection of Life's Metabolic and Genetic Machinery", *Astrobiology*, 3, 489 (2003)
19. J. Xu, J.J. Bock, K.M. Ganga, V. Gorjian, K. Uemizu, M. Kawada, A.E. Lange, T. Matsumoto, T. Watabe, "Measurement of Sky Surface Brightness Fluctuations at $\lambda = 4 \mu\text{m}$ ", *Astrophys. J.*, 580, 653 (2002)
20. J. Xu, A.E. Lange, J.J. Bock, "Far-Infrared Emissivity Measurements of Reflective Surfaces", 30th ESLAB Symposium, ESA SP-388, 69 (1996)

*: co-primary authors.

^T: co-corresponding authors.

Invited Presentations

1. "Cytoplasmic Dynein Travel Cut Short by a Neurodegenerative Mutation in Its Tail", Platform, Biophysics Society Annual Meeting (2010).
2. "Dynein Regulation Revealed by a Neurodegenerative Mutation", Seminar, European Molecular Biology Laboratory (EMBL), Heidelberg, (2009)
3. "Terahertz Spectroscopy of Biopolymers in Water: Absorption and Circular Dichroism", Keynote, Joint 31st International Conference on Infrared and Millimeter Waves and 14th International Conference on Terahertz Electronics (2006)
4. "Terahertz Spectroscopy of Biopolymers in Water: Absorption and Circular Dichroism", IEEE Lester Eastman Conference on High Performance Devices (2006)
5. "Terahertz Spectroscopy of Biomolecules in Liquid Water", Free Electron Laser Workshop, American Physical Society Annual March Meeting (2006)
6. "Terahertz Circular Dichroism Spectroscopy of Biomolecules", Seminar, Jet Propulsion Laboratory (2005)

Contributed Presentations/Posters

American Physical Society Annual March Meeting (2012, 2011, 2006, 2004, 2003)
Biophysical Society Annual Meeting (2012, 2011, 2010)

American Society for Cell Biology Annual Meeting (2012, 2011, 2010)
International Conference on Biological Physics (2011)
Soft Matter Physics Approaches to Biology, Kavli Institute for Theoretical Physics Conference (2011)
Single Molecule Biophysics Winter Meeting (2011)
California American Physical Society Annual Meeting (2010)
Conference: Single Molecule Approaches to Biology (2010)
International Symposium on Spectral Sensing Research (2006)

Professional Services

Reviewer for Lab on a Chip, Langmuir

Professional Memberships

American Physical Society
American Society of Cell Biology
Biophysical Society

Lin Tian

University of California, Merced, 5200 North Lake Road, Merced CA 95343 USA
Tel: 209 228 4209 Fax: 209 228 4060 Email: LTian@ucmerced.edu
Website: <http://faculty.ucmerced.edu/ltian>

EDUCATION

- Ph.D. in Physics (2002), Massachusetts Institute of Technology, Cambridge MA
- M.S. in Physics (1997), Peking University, Beijing China
- B.S. in Physics (1994), Tsinghua University, Beijing China

RESEARCH APPOINTMENTS

- Assistant Professor, Physics, University of California, Merced, July 2008 -
- Karel Urbanek Postdoc Fellow, Stanford University, 2007 - 2008
- Contractor, National Institute of Standards and Technology at Gaithersburg, 2005 - 2006
- Visiting Scholar, Universität Karlsruhe, Germany, 2004
- Postdoctoral Researcher, Universität Innsbruck, Austria, 2002 - 2004
- Graduate Research Assistant, Massachusetts Institute of Technology, 1997 - 2002

AWARDS

- NSF Faculty Early CAREER Award, 2010 - 2015
- Karel Urbanek Postdoctoral Fellowship, Stanford University, 2007 - 2008
- Guanghua student fellowship, Beijing University, 1995, 1997
- Guanghua student fellowship, Tsinghua University, 1990, 1991, 1993

RESEARCH GRANTS

- L. Tian (Single PI Award), NSF Faculty Early CAREER Award, “CAREER: Quantum Optics in Nanoscale Devices Approaching the Quantum Limit”, 06/2010 - 05/2015, \$450,000.
- L. Tian (Co-PI, Joint Award), DARPA ORCHID Program, “Optomechanical Light-Matter Interface and Wavelength Conversion”, 07/2010 - 06/2014, total \$1,000,000 with \$300,000 to my group at UCM.
- L. Tian (PI, Subaward), NSF COINS Program, “Integrated Quantum Network with Nanomechanical Systems”, 09/2011 - 08/2012, \$5,320.
- L. Tian (Single PI Award), NSF CISE Program, “SHF: Small: Global Manipulation in Solid-State Quantum Information Processing-Protocols and Implementation”, 06/2009 - 05/2012, \$300,967.
- L. Tian (PI, Subaward), NSF COINS Program, “Integrated Quantum Network with Nanomechanical Systems”, 09/2010 - 08/2011, \$4,560.
- L. Tian (Single PI Award), UCM Graduate Research Council, “Quantum Engineering of Nanomechanical Systems in the Quantum Limit”, 04/2009 - 06/2010, \$3,725.

PUBLICATIONS

Manuscripts

- C. Dong, V. Fiore, M. C. Kuzyk, **L. Tian**, and H. Wang, “Optical wavelength conversion via optomechanical coupling in a silica resonator”, preprint online arXiv:1205.2360 (2012).
- X. Deng, Y. Hu, and **L. Tian**, “Universal quantum degeneracy point for superconducting qubits”, preprint online arXiv:1101.2942 (2011).
- **L. Tian**, F. Fujiwara, T. Byrnes, and Y. Yamamoto, “Interference in the Mott insulator state of distinguishable particles”, preprint online arXiv:0705.2023 (2007).

Journal Articles

- A. V. Sharypov, X. Deng, and **L. Tian**, “Parametric four-wave mixing toolbox for superconducting resonators”, Phys. Rev. B **86**, 014516 (2012).
- **L. Tian**, “Adiabatic State Conversion and Pulse Transmission in Optomechanical Systems”, Phys. Rev. Lett. **108**, 153604 (2012).
- V. Fiore, Y. Yang, M. Kuzyk, R. Barbour, **L. Tian**, and H. Wang, “Storing light as a mechanical excitation in a silica optomechanical resonator”, Phys. Rev. Lett. **107**, 133601 (2011).
- **L. Tian**, “Cavity cooling of a mechanical resonator in the presence of a two-level-system defect”, Phys. Rev. B **84**, 035417 (2011).
- Y. Hu and **L. Tian**, “Deterministic generation of entangled photons in superconducting resonator arrays”, Phys. Rev. Lett. **106**, 257002 (2011).
- **L. Tian**, “Circuit QED and sudden phase switching in a superconducting qubit array”, Phys. Rev. Lett. **105**, 167001 (2010).
- **L. Tian** and H. Wang, “Optical wavelength conversion of quantum states with optomechanics”, Phys. Rev. A **82**, 053806 (2010).
- **L. Tian** and K. Jacobs, “A controllable interaction between two-level systems inside a Josephson junction”, IEEE Tran. Appl. Supercond. **19**, 953 (2009).
- K. Jacobs, **L. Tian**, and J. Finns, “Engineering superposition states and tailored probes for nano-resonators via open-loop control”, Phys. Rev. Lett. **102**, 057208 (2009).
- **L. Tian**, “Ground state cooling of nanomechanical resonator via parametric linear coupling”, Phys. Rev. B **79**, 193407 (2009).
- **L. Tian** and K. Jacobs, “Quantum manipulation of low-frequency fluctuators by superconducting resonator”, Phys. Rev. B **79**, 144503 (2009).
- **L. Tian**, M S Allman, and R. W. Simmonds, “Parametric coupling between macroscopic quantum resonators”, New J. Phys. **10**, 115001 (2008).
- S. Utsunomiya, **L. Tian**, G. Roumpos, C. W. Lai, N. Kumada, T. Fujisawa, M. Kuwata-Gonokami, A. Loeffler, S. Hoefling, A. Forchel, and Y. Yamamoto, “Observation of Bogoliubov excitations in exciton-polariton condensates”, Nat. Phys. **4**, 700 (2008).
- Y. C. N. Na, S. Utsunomiya, **L. Tian**, and Y. Yamamoto, “Strongly correlated polaritons in a two-dimensional array of photonic crystal microcavities”, Phys. Rev. A **77**, 031803 (2008).
- **L. Tian**, “Correcting low-frequency noise with continuous measurement”, Phys. Rev. Lett. **98**, 153602 (2007).
- **L. Tian** and R. W. Simmonds, “Josephson junction microscope for low-frequency fluctuators”, Phys. Rev. Lett. **99**, 137002 (2007).

- **L. Tian** and S. M. Carr, “Quantum teleportation between nanomechanical modes”, Phys. Rev. B **74**, 125314 (2006).
- **L. Tian**, “Entanglement from a nanomechanical resonator weakly coupled to a single Cooper-pair box”, Phys. Rev. B **72**, 195411 (2005).
- **L. Tian**, R. Blatt and P. Zoller, “Scalable ion trap quantum computing without moving the ions”, Eur. J. Phys. D **32**, 201 (2005).
- **L. Tian** and P. Zoller, “Coupled ion - nanomechanical systems”, Phys. Rev. Lett. **93**, 266403 (2004).
- I. Martin, A. Shnirman, **L. Tian**, and P. Zoller, “Ground state cooling of mechanical resonators”, Phys. Rev. B **69**, 125339 (2004).
- **L. Tian**, P. Rabl, R. Blatt, and P. Zoller, “Interfacing quantum optical and solid state qubits”, Phys. Rev. Lett. **92**, 247902 (2004).
- A. Imamoglu, E. Knill, **L. Tian**, and P. Zoller, “Optical pumping of quantum-dot nuclear spins”, Phys. Rev. Lett. **91**, 017402 (2003).
- **L. Tian** and P. Zoller, “Quantum computing with atomic Josephson junction arrays”, Phys. Rev A **68**, 042321 (2003).
- **L. Tian**, S. Lloyd, and T. P. Orlando, “Projective measurement scheme for solid-state qubits”, Phys. Rev. B **67** R220505 (2003).
- T. P. Orlando, **L. Tian**, D.S. Crankshaw, S. Lloyd, C.H. van der Wal, J.E. Mooij, and F. Wilhelm, “Engineering of measurement induced noise”, Physica C **368**, 294 (2002).
- **L. Tian**, S. Lloyd and T. P. Orlando, “Decoherence and relaxation of superconducting persistent-current qubit during measurement”, Phys. Rev. B. **65**, 144516 (2002).
- **L. Tian** and S. Lloyd, “Resonant cancellation of off-resonant effects in a multilevel qubit”, Phys. Rev. A **62**, R050301 (2000)
- T. P. Orlando, J. E. Mooij, **L. Tian**, C. H. van der Wal, L. S. Levitov, and S. Lloyd, “Superconducting persistent-current qubit”, Phys. Rev. B **60**, 15398 (1999).
- J. E. Mooij, T. P. Orlando, L. S. Levitov, **L. Tian**, C. H. van der Wal, and S. Lloyd, “Josephson persistent-current qubit”, *Science* **285**, 1036 (1999).
- **L. Tian**, Y. Yi, C. L. Wang, and Z. B. Su, “E \otimes e Jahn-Teller effect in C₇₀³⁻ systems”, Int. J. Mod. Phys. B **11**, 1969 (1997).
- Y. Yi, **L. Tian**, C. L. Wang, and Z. B. Su, “Self-consistent treatment for dynamical Jahn-Teller effect in C₆₀⁺: In comparison with C₆₀⁻”, Physica C **282**, 1927 (1997).
- G. L. Long, S. J. Zhu, **L. Tian** *et al.*, “Band Structure in ⁹⁸Sr”, Phys. Lett. B **345**, 351 (1995).

Book Chapters

- **L. Tian**, L. S. Levitov, C. H. van der Wal, J. E. Mooij, T. P. Orlando, S. Lloyd, C. J. P. M. Harmans, and J. J. Mazo, “Decoherence of the superconducting persistent-current qubit”, Proceedings of the NATO-ASI on *Quantum Mesoscopic Phenomena and Mesoscopic Devices in Microelectronics*, (Kluwer Academic, 2000), see also arXiv:cond-mat/9910062.
- C. L. Wang, Y. Yi, **L. Tian**, and Z. B. Su, “Symmetries of Jahn-Teller states in charged Fullerenes”, Proceedings of the NATO-ASI on *Vibronic Interactions: Jahn-Teller Effect in Crystals and Molecules*, (Kluwer Academic, 2001).

Carrie Ann Menke

University of California, Merced
Physics
Office Phone: (209) 228-3078
Department Phone: (209) 228-4309
Fax: (209) 228-4060
Email: cmenke@ucmerced.edu
Website: <http://faculty1.ucmerced.edu/cmenke/>

Research Interests

I'm interested in physics education research, pedagogy, and assessment. I'm gathering data to determine the efficacy of our introductory physics courses as compared to other UC campuses, national measures, and other universities that have a student demographic similar to ours.

Education

PhD, University of California, Irvine, 2005.

Major: Physics/Chemical and Materials Physics

Dissertation Title: Selected Chemical Physics Studies of Weakly Bound Systems

Advisor: Janda, K. C.

MS, University of California, Irvine, 2002.

Major: Physics/Chemical and Materials Physics

Dissertation Title: Vibrational Spectroscopy of Solvation in a Hydrogen-Bonded System: A Study of (NH₃)(HF)

Advisor: Janda, K. C.

BS, *Cum laude*, University of Tennessee, 1996.

Major: Physics

Professional Positions

Lecturer, Physics, University of California, Merced (2008-2012).

Lecturer PSOE, Physics, University of California, Merced (2010-2011).

Professional Memberships

American Association of Physics Teachers. (July 2011 - Present).

RESEARCH

Published Intellectual Contributions

Journal Articles

Bouchard, M., Rivenc, R., **Menke, C. A.**, Learner, T. (2009). Micro-FTIR and micro-RAMAN study of paints used by Sam Francis. *e-Preservation Science*, 6, 27-37. Publisher - Morana RTD. (Date Published - 2009).

Menke, C. A., Rivenc, R., Learner, T. (2008). The use of direct temperature-resolved mass spectrometry (DTMS) in the detection of organic pigments found in acrylic paints used by Sam Francis. *International Journal of Mass Spectrometry*, 284(1-3), 2-11. Publisher - Elsevier. (Date Published - 2008).

Professional Development

Conference Attendance, "Physics Education Research (PER) Conference," PER, Omaha, Nebraska. (August 2011).

Research in Progress

"Efficacy of Introductory Physics Courses" (On-Going)

Question: How do UC Merced student knowledge gains compare to national norms, other UC campuses, and other campuses with student demographics similar to our? Current state: collecting data using research-based Inventories (ie. Force Concept Inventory), while investigating additional modes of data collection based on physics education research.

TEACHING

Teaching Experience

University of California, Merced

Spring, 2012

PHYS 18, Introductory Physics I for Biological Sciences. (Spring 2012)

PHYS 9, Introductory Physics II. (Spring 2012)

Fall, 2011

PHYS 18, Introductory Physics I for Biological Sciences. (Fall 2011)

PHYS 8, Introductory Physics I. (Fall 2011)

Spring, 2011

PHYS 19, Introductory Physics II for Biological Sciences. (Spring 2011)

PHYS 8, Introductory Physics I. (Spring 2011)

Fall, 2010

PHYS 18, Introductory Physics I for Biological Sciences. (Fall 2010)

PHYS 8, Introductory Physics I. (Fall 2010)

Spring, 2010

PHYS 105, Analytic Mechanics. (Spring 2010)

PHYS 19, Introductory Physics II for Biological Sciences. (Spring 2010)

PHYS 8, Introductory Physics I. (Spring 2010)

Fall, 2009

PHYS 19, Introductory Physics II for Biological Sciences. (Fall 2009)

PHYS 8, Introductory Physics I. (Fall 2009)

Summer, 2009

PHYS 8, Introductory Physics I. (Summer 2009)

Spring, 2009

PHYS 105, Analytic Mechanics. (Spring 2009)

PHYS 19, Introductory Physics II for Biological Sciences. (Spring 2009)

Fall, 2008

PHYS 18, Introductory Physics I for Biological Sciences. (Fall 2008)

PHYS 19, Introductory Physics II for Biological Sciences. (Fall 2008)

Other

Guest Lecture, (March 2012).

Topic: Test Preparation and Test-taking strategies

Weekly Study Skills Meeting, (September 2011 - December 2011).

Study Skills in Physics: weekly meeting with introductory physics students to promote study skills immediately applicable to the course. Topics included learning styles, time management, connecting ideas in physics, test prep, problem-solving strategies, etc.

Guest Lecture, (October 2011).

Topic: Test Preparation and Test-taking strategies

Guest Lecture, (February 2011).

Topic: Test Preparation and Test-taking strategies

Guest Lecture, (September 2010).

Topic: Test Preparation and Test-taking strategies

Guest Lecture, (September 28, 2010).

'Providing Effective Feedback & Accurate Grades,' included in the CRTE's Teaching Matter Series directed to teaching assistants. Included a grading exercise.

SERVICE

Department Service

Coordinator, WASC Coordinator. (September 2011 - Present).

Member, Physics Undergraduate Affairs Committee. (September 2010 - Present).

Co-Coordinator, Recruitment, Retention, and Outreach. (September 2010 - Present).

Design and provide training for TAs, Teaching Assistant Training. (August 2010 - Present).

Mentor, Faculty Mentor for Lecturer Konstantinos Tsekouras. (May 2012 - August 2012).

Mentor, Faculty Mentor for Lecturer Mario Badal. (May 2012 - August 2012).

Mentor, Faculty Mentor for Lecturer Heather Heck. (August 2011 - May 2012).

School/College Service

Mentor, Teaching Assistant Mentor. (2011 - Present).

Chair, NSF Continuing Appointment Review Committee. (March 2012 - April 2012).

University Service

Member, First Year Experience (FYE) Faculty. (September 2010 - Present).

Guest Speaker, ASCEND 2012 Presenter. (May 2012 - August 2012).

Attendee, Fiat Lux Scholars Faculty Reception. (March 2012).

Guest Speaker, Women in Science and Engineering Presentation Series. (September 2011).

Member, ASCEND 2011 Planning Committee. (January 2011 - August 2011).

Public Service

Guest Speaker, Science Fair at Chenoweth Elementary, Merced, California. (December 2009).

Michael Scheibner

University of California, Merced
Physics
Office Phone: (209) 228-4873
Department Phone: (209) 228-4309
Fax: (209) 228-4053
Email: mscheibner@ucmerced.edu
Website: <http://faculty.ucmerced.edu/mscheibner/>

Research Interests

I am devoted to the investigation, creation, manipulation, and control of novel solid state materials with superior properties. The thrust of my research is to develop a comprehensive understanding of the interaction mechanisms between quantum structures, with the objective to apply the coupling mechanisms as tools in future quantum technologies.

Education

Dr. rer.nat., *Summa cum laude*, University of Wurzburg, 2006.
Major: Physics
Dissertation Title: Dynamics of locally interacting spin carriers
Advisor: Bacher, G.

Diplom Physiker, University of Wurzburg, 2001.
Major: Physics
Dissertation Title: Spin dynamics in low dimensional semiconductor structures
Advisor: Bacher, G.

MS, University of New Mexico, 1999.

Professional Positions

Assistant Professor, Physics, University of California, Merced (2009-2012).

Postdoctoral researcher, Naval Research Laboratory. (2005 - 2009).
Employment through the University of Wuerzburg

Dr.rer.nat. (summa cum laude), University of Wurzburg. (2006).
Thesis Title: Dynamics of locally interacting spin carriers

Researcher, Naval Research Laboratory. (2003).

Diplom Physiker, University of Wurzburg. (2001).
Physics major. Thesis title: Spin dynamics in low dimensional semiconductor structures

Master of Science, University of New Mexico. (1998 - 1999).
Participated in an exchange program between the Physics & Astronomy departments of the University of Wurzburg and the University of New Mexico in Albuquerque

Civilian Service, Hospital Ebern. (1994 - 1995).
Mandatory Civilian Service in the surgery unit of the county hospital

Professional Memberships

European Physical Society (EPG). (2010 - Present).

American Physical Society (APS). (2005 - Present).

German Physical Society (DPG). (2002 - Present).

Awards and Honors

Alan Berman - Best Paper Post-doc Award, Naval Research Laboratory. (2007).
Awarded to the papers:
- "Optical Signatures of Coupled Quantum Dots", Science 311, 636 (2006)
- "Electrically tunable g-factors in quantum dot molecular spin states", Phys. Rev. Lett. 97, 197202 (2006)

Commemoration Year Foundation for Science of Lower Franconia, Government of Lower Franconia. (2007).

Wilhelm Conrad Rontgen Science Award, Institute of Physics, University of Wuerzburg. (2006).

RESEARCH

Published Intellectual Contributions

Book Chapters

20. Doty, M.F., **Scheibner, M.**, Bracker, A.S., Gammon, D. (2009). Optical Spectroscopy of Spins in Quantum Dots. In P. Michler (Ed.), *Single Semiconductor Quantum Dots*. Springer. Publisher - Springer. 3540874453. (Date Published - June 16, 2009).

Conference/Workshop/Symposium Proceedings

33. Wijesundara, K. C., Garrido, M., Ramanathan, S., Stinaff, E. A., **Scheibner, M.**, Bracker, A. S., Gammon, D. (2009). Electric field tunable exchange interaction in InAs/GaAs coupled quantum dots. In *MRS Proceedings. MRS Fall Meeting 2008*, Vol. 1117E, (pp. 1117-J04-08). (Date Published - March 2009).
32. Garrido, M., Wijesundara, K. C., Ramanathan, S., Stinaff, E. A., **Scheibner, M.**, Bracker, A. S., Gammon, D. (2009). Characterization of the shell structure in coupled quantum dots through resonant optical probing. In *MRS Proceedings. MRS Fall Meeting 2008*, Vol. 1117E, (pp. 1117-J05-03). (Date Published - March 2009).
29. **Scheibner, M.** (2007). Coupling of optically active quantum dots. In *LEOS. Proceedings of the 20th Annual Meeting of the IEEE Laser & Electro-Optics Society of America*, Lake Buena Vista, FL. (Date Published - 2007).
27. **Scheibner, M.**, Bracker, A.S., Stinaff, E.A., Doty, M.F., Gammon, D., Ponomarev, I.V., Reinecke, T.L., Korenev, V.L. (2007). Optical Spectroscopy of Charged Quantum Dot Molecules. In *AIP Conference Proceedings Subseries. Proceedings of the 28th ICPS*, Vol. 893, Vienna, Austria. (Date Published - 2007).
14. Ponomarev, I.V., Reinecke, T.L., **Scheibner, M.**, Stinaff, E.A., Bracker, A.S., Doty, M.F., Gammon, D., Korenev, V.L. (2007). Theory of spin states quantum dot molecules. In *AIP Conference Proceedings Subseries. Proceedings of the 28th ICPS*, Vol. 893, Vienna, Austria. (Date Published - 2007).

Journal Articles

34. **Scheibner, M.**, Bracker, A. S., Kim, D., Gammon, D. (2009). Essential concepts in the optical properties of quantum dot molecules. *Solid State Communications*, 149, 1427-1435. Publisher - Elsevier. (Date Published - September 2009).
31. **Scheibner, M.**, Yakes, M., Bracker, A.S., Ponomarev, I.V., Doty, M.F., Hellberg, C.S., Whitman, L.J., Reinecke, T.L., Gammon, D. (2008). Optically Mapping the Electronic Structure of Coupled Quantum Dots. *Nature Physics*, 4(291). Publisher - Nature Physics. (Date Published - 2008).
30. **Scheibner, M.**, Ponomarev, I.V., Stinaff, E.A., Doty, M.F., Bracker, A.S., Hellberg, C.S., Reinecke, T.L., Gammon, D. (2007). Photoluminescence Spectroscopy of the Molecular Bexciton in Vertically Stacked InAs-GaAs Quantum Dot Pairs. *Physical Review Letters*, 99(197402). Publisher - Physical Review Letters. (Date Published - 2007).
28. **Scheibner, M.**, Doty, M.F., Ponomarev, I.V., Bracker, A.S., Stinaff, E.A., Korenev, V.L., Reinecke, T.L., Gammon, D. (2007). Spin Fine Structure in Optically Excited Quantum Dot Molecules. *Physical Review B*, 75(245318). Publisher - Physical Review B. (Date Published - 2007).
26. **Scheibner, M.**, Schmidt, T., Worschech, L., Forchel, A., Bacher, G., Passow, T., Hommel, D. (2007). Superradiance of Quantum Dots. *Nature Physics*, 3(106). Publisher - Nature Physics. (Date Published - 2007).

25. **Scheibner, M.**, Kennedy, T.A., Worschech, L., Forchel, A., Bacher, G., Slobodskyy, T., Schmidt, G., Molenkoamp, L.W. (2006). Coherent dynamics of locally interacting spins in self-assembled Cd(1-x)Mn(x)Se/ZnSe quantum dots. *Physical Review B*, 73(81308). Publisher - Physical Review B. (Date Published - 2006).
24. **Scheibner, M.**, Seufert, J., Schomig, H., Bacher, G., Forchel, A. (2003). Spin and polarization dynamics in magnetic and non-magnetic semiconductor quantum dots. *Proceedings of SPIE*, 4992(1). Publisher - Proceedings of SPIE. (Date Published - 2003).
23. **Scheibner, M.**, Bacher, G., Weber, S., Forchel, A., Passow, T., Hommel, D. (2003). Polarization dynamics in self-assembled CdSe/ZnSe quantum dots - the role of excess energy. *Physical Review B*, 67(153302). Publisher - Physical Review B. (Date Published - 2003).
22. **Scheibner, M.**, Bacher, G., Forchel, A., Passow, T., Hommel, D. (2003). Spin dynamics in CdSe/ZnSe quantum dots: resonant versus non-resonant excitation. *Journal of Superconductivity: Incorporating Novel Magnetism*, 16(395). Publisher - Journal of Superconductivity: Incorporating Novel Magnetism. (Date Published - 2003).
21. Doty, M. F., Climente, J. I., Korkusinski, M., **Scheibner, M.**, Bracker, A. S., Hawrylak, P., Gammon, D. (2009). Antibonding Ground States in InAs Quantum-Dot Molecules. *Physical Review Letters*, 102, 047401. Publisher - The American Physical Society. (Date Published - January 30, 2009).
19. Kim, D., Economou, S., Badescu, S., **Scheibner, M.**, Bracker, A.S., Bashkansky, M., Reinecke, T.L., Gammon, D. (2008). Optical Spin Initialization and Non-Destructive Measurement in a Quantum Dot Molecule. *Physical Review Letters*, 101(236804). Publisher - Physical Review Letters. (Date Published - 2008).
18. Stinaff, E.A., Ramanathan, S., Wijesundara, K.C., Garrido, M., **Scheibner, M.**, Bracker, A.S., Gammon, D. (2008). Polarization dependent photoluminescence of charged quantum dot molecules. *physica status solidi c*, 5(2464). Publisher - physica status solidi c. (Date Published - 2008).
17. Doty, M.F., **Scheibner, M.**, Bracker, A.S., Ponomarev, I.V., Reinecke, T.L., Gammon, D. (2008). Spins in optically excited doubly charged quantum dot molecules. *Physical Review B*, 78(115316). Publisher - Physical Review B. (Date Published - 2008).
16. Schmidt, T., Worschech, L., **Scheibner, M.**, Slobodskyy, T., Molenkamp, L.W., Forchel, A. (2007). Spin Polarization in Semimagnetic CdMnSe/ZnSe Quantum Dots with Zero Exciton g Factor. *International Journal of Modern Physics B*, 21(1626). Publisher - International Journal of Modern Physics B. (Date Published - 2007).
15. Schmidt, T., Worschech, L., **Scheibner, M.**, Slobodskyy, T., Schmidt, G., Molenkamp, L.W., Passow, T., Hommel, D., Forchel, A. (2007). Light controlled spin properties and radiative coupling of CdSe based quantum dots. *physica status solidi c*, 4(3334). Publisher - physica status solidi c. (Date Published - 2007).
13. Schmidt, T., **Scheibner, M.**, Worschech, L., Forchel, A., Slobodskyy, T., Molenkamp, L.W. (2006). Sign reversal and light controlled tuning of circular polarizaiton in semimagnetic CdMnSe quantum dots. *Journal of Applied Physics*, 100(123109). Publisher - Journal of Applied Physics. (Date Published - 2006).
12. Bracker, S., **Scheibner, M.**, Doty, M.F., Stinaff, E.A., Ponomarev, I.V., Kim, J.C., Whitman, L.J., Reinecke, T.L., Gammon, D. (2006). Engineering electron and hole tunneling with asymmetric InAs quantum dot molecules. *Applied Physics Letters*, 89(233110). Publisher - Applied Physics Letters. (Date Published - 2006).
11. Doty, M.F., Ware, M.E., Stinaff, E.A., **Scheibner, M.**, Bracker, A.S., Ponomarev, I.V., Badescu, S.C., Korenev, V.L., Reinecke, T.L., Gammon, D. (2006). Spin Interactions in

InAs Quantum Dots and Molecules. *physica status solidi c*, 243(3859). Publisher - physica status solidi c. (Date Published - 2006).

10. Doty, M.F., **Scheibner, M.**, Ponomarev, I.V., Stinaff, E.A., Bracker, A.S., Korenev, V.L., Reinecke, T.L., Gammon, D. (2006). Electrically tunable g-factors in quantum dot molecular spin states. *Physical Review Letters*, 97(197202). Publisher - Physical Review Letters. (Date Published - 2006).
9. Ponomarev, I.V., **Scheibner, M.**, Stinaff, E.A., Bracker, A.S., Doty, M.F., Badescu, S.C., Ware, M.E., Korenev, V.L., Reinecke, T.L., Gammon, D. (2006). Theory of spin states in quantum coupled dots. *physica status solidi c*, 243(3869). Publisher - physica status solidi c. (Date Published - 2006).
8. Stinaff, E.A., **Scheibner, M.**, Bracker, A.S., Ponomarev, I.V., Korenev, V.L., Ware, M.E., Doty, M.F., Reinecke, T.L., Gammon, D. (2006). Optical Signatures of Coupled Quantum Dots. *Science*, 311(636). Publisher - Science. (Date Published - 2006).
7. Kennedy, T.A., Shabaev, A., **Scheibner, M.**, Efros, A., Bracker, A.S., Gammon, D. (2006). Optical initialization and dynamics in a remotely doped quantum well. *Physical Review B*, 73(45307). Publisher - Physical Review B. (Date Published - 2006).
6. Bacher, G., Schomig, H., **Scheibner, M.**, Forchel, A., Maksimov, A.A., Chernenko, A.V., Dorozhkin, P.S., kulakovskii, V.D., Kennedy, T., Reinecke, T.L. (2005). Spin-Spin interaction in magnetic semiconductor quantum dots. *Physica E*, 26(37). Publisher - Physica E. (Date Published - 2005).
5. Seufert, J., Bacher, G., **Scheibner, M.**, Forchel, A., Lee, S., Dobrowolska, M., Furdyna, J. K. (2002). Dynamical spin response in semimagnetic quantum dots. *Physical Review Letters*, 88, 027402. Publisher - The American Physical Society. (Date Published - 2002).
4. Bacher, G., Schomig, H., Welsch, M.K., **Scheibner, M.**, Seufert, J., Obert, M., Forchel, A., Maksimov, A.A., Zaitsev, S., Kulakovskii, V.D. (2002). Nano-optics on individual quantum objects - from single to coupled semiconductor quantum dots. *Acta Physica Polonica A*, 102(475). Publisher - Acta Physica Polonica A. (Date Published - 2002).
3. Seufert, J., **Scheibner, M.**, Bacher, G., Forchel, A., Lee, S., Dobrowolska, M., Furdyna, J. K. (2002). Dynamics of zero-dimensional excitons in a semimagnetic environment. *physica status solidi b*, 229(727). Publisher - physica status solidi b. (Date Published - 2002).
2. Seufert, J., Obert, M., **Scheibner, M.**, Gippius, N.A., Bacher, G., Forchel, A., Passow, T., Leonardi, K., Hommel, D. (2001). Stark effect and polarizability in a single CdSe/ZnSe quantum dot. *Applied Physics Letters*, 79(1033). Publisher - Applied Physics Letters. (Date Published - 2001).
1. Oetiker, B., Duric, N., McGraw, J., Williams, T., Jackson, D., **Scheibner, M.**, Garcia, D., Wilcox, E., Deeg, H. J. (2000). Searching for companions to late-type M stars. *ASP Conference Series*, 212(88). Publisher - ASP Conference Series. (Date Published - 2000).

Scheibner, M., Economou, S. E., Ponomarev, I. V., Bracker, A. S., Gammon, D. (2012). Entangled Photon Generation With Quantum Dot Molecules. *Journal of the Optical Society of America B*, 29, A82-A85. Publisher - Optical Society of America. (Date Published - February 1, 2012).

Presentations Given

- Kerfoot, M. (Author), Lu, D. (Author), Bracker, A. S. (Author), Gammon, D. (Author), Scheibner, M. (Presenter & Author), NSF-COINS, Site Visit, "Single Phonon Transport Between Quantum Dots," NSF, UC Berkeley. (April 2012 - Present).
- Scheibner, M., "Artificial Molecules and Controlling Single Electrons with Light," RWTH Aachen University, RWTH Aachen University, Aachen Germany. (March 2010 - Present).

- Scheibner, M. (Presenter & Author), Gammon, D. (Author), Bracker, A. S. (Author), Economou, S. E. (Author), Ponomarev, I. V. (Author), International Conference on Quantum Dots -QD2012, "Entangled Photon Generation With Quantum Dot Molecules," Santa Fe, NM. (May 2012).
- Scheibner, M., "Many is not just more, it's different," UC Merced, SNS-Physics, Merced, CA. (October 2011).
- Scheibner, M. (Author), Kerfoot, M. (Presenter & Author), Gammon, D. (Author), Bracker, A. S. (Author), APS March Meeting 2011, "Resonant Fluorescence from Quantum Dot Molecular Excitonic Transitions," American Physical Society, Dallas, TX. (March 2011).
- Scheibner, M., ONR Workshop on 'Entanglement beyond the optical regime', "Essential Concepts for spin initialization, entanglement, and wavelength shifting of entangled photons with coupled quantum dots," Office of Naval Research (ONR), Doubletree Hotel, 100 The City Dr. Orange, CA. (February 2010).
- Scheibner, M., Special Physics Colloquium, Department of Physics UCSD, "Optical Spin Control in Artificial Molecules," UC San Diego. (April 2009).
- Scheibner, M., APS March Meeting 2009, "Two-Photon Transitions in Molecular Quantum Dot Systems," The American Physical Society, Pittsburgh PA. (March 2009).
- Scheibner, M., "Optical Spin Control in Artificial Molecules," UC Merced, SNS, Merced, CA. (March 2009).
- Scheibner, M., Graduate Lecture Series, "Optical Signatures of Coupled Quantum Dots," Physics Department, University of Paderborn, Paderborn, Germany. (October 2008).
- Scheibner, M., Condensed Matter Seminar, "Optically Active Artificial Molecules," Forschungszentrum Julich, Julich, Germany. (October 2008).
- Scheibner, M., Condensed Matter and Surface Sciences Colloquium, "Optically Active Artificial Molecules," Ohio University, Ohio. (October 2008).
- Scheibner, M., Technical Physics Group Seminar, "Excitonic Quantum Dot Molecules," University of Wurzburg, Wurzburg, Germany. (September 2008).
- Scheibner, M., Condensed Matter Seminar, "Optically Driven Quantum Dot Molecules," University of Dortmund, Dortmund, Germany. (September 2008).
- Scheibner, M., Workshop of the SFB-445, "Optically Driven Quantum Dot Molecules," University of Duisburg-Essen, Duisburg-Essen, Germany. (September 2008).
- Scheibner, M., 15th International Conference on Superlattices, Nanostructures, and Nanodevices, "Level Anti-Crossing Spectroscopy--Optically Mapping the Electronic Structure of Coupled Quantum Dots," Natal, Brazil. (August 2008).
- Scheibner, M., 29th Annual International Conference on the Physics of Semiconductors, "Two-Photon Excitation Spectroscopy of Molecular Biexcitons in InAs/GaAs Quantum Dot Molecules," Rio de Janeiro, Brazil. (July 2008 - August 2008).
- Scheibner, M., APS March Meeting 2008, "Level Anti-Crossing Spectroscopy--Optically Mapping the Electronic Structure of Coupled Quantum Dots," New Orleans, LA. (March 2008).
- Scheibner, M., 20th Annual Meeting of the Laser and Electro-Optical Society of America, "Coupling of Optically Active Quantum Dots," Laser and Electro-Optical Society of America, Orlando, FL. (October 2007).
- Scheibner, M., Closing Colloquium of the SFB410, "Coupling Between Optically Active Quantum Dots," University of Wurzburg, Wurzburg, Germany. (July 2007).
- Scheibner, M., APS March Meeting 2007, "Spin Fine Structure in the Optical Spectra of Quantum Dot Molecules," Denver, CO. (March 2007).
- Scheibner, M., APS March Meeting 2007, "Superradiance of Quantum Dots," Denver, CO. (March 2007).
- Scheibner, M., "Optically Driven Quantum Dot Molecules," Werkstoffe der Elektrotechnik (WET) University of Duisburg-Essen, Duisburg-Essen, Germany. (September 2006).
- Scheibner, M., "Optically Driven Quantum Dot Molecules," Walter-Schottky Institute/TU, Munich, Germany. (September 2006).
- Scheibner, M. (Plenary Lecturer), 28th International Conference on the Physics of Semiconductors, "Fine Structure in the Optical Spectra of Quantum Dot Molecules," Vienna, Austria. (July 2006).
- Scheibner, M., 28th International Conference on the Physics of Semiconductors, "Optical Spectroscopy of Charged Quantum Dot Molecules," Vienna, Austria. (July 2006).

- Scheibner, M., APS March Meeting 2006, "Multi-Excitonic Quantum Dot Molecules," Baltimore, MD. (March 2006).
- Scheibner, M., 12th International Conference on Modulated Semiconductor Structures, "Long Range Quantum Dot Interaction," Albuquerque, NM. (July 2005).
- Scheibner, M., 3rd International Conference on Physics and Applications of Spin-related Phenomena in Semiconductors, "Coherent spin dynamics in manganese-doped self-assembled quantum dots," Santa Barbara, CA. (July 2004).
- Scheibner, M., 11th International Conference on II-VI Compounds, "Polarization Dynamics in Cd(Mn)Se/ZnSe Quantum Dots," Niagara Falls, NY. (September 2003).
- Scheibner, M., International Conference on the Physics of Semiconductors, "Spin Coherence and Radiative Lifetime in CdSe/ZnSe Quantum Dots," Edinburgh, Scotland. (July 2002 - August 2002).
- Scheibner, M., 2nd International Conference on Physics and Application of Spin Related Phenomena in Semiconductors, "Spin Coherence and Radiative Lifetime in CdSe/ZnSe Quantum Dots," Wurzburg, Germany. (July 2002).
- Scheibner, M., DPG-Fruhjahrstagung, "Spinkohärenz in selbstorganisierten CdSe/ZnSe-Quantenpunkten," Regensburg, Germany. (March 2002).

Contracts, Grants and Sponsored Research

Grant

- Scheibner, Michael (Principal Investigator), "Single Phonon Transport Between Quantum Dots," NSF - National Science Foundation, \$25,913.00. (September 2011 - August 2012).

Professional Service

- Physical Review Letters (4), Micro-Nano Letters (1), Physical Review B (2), ACS Nano (1), Journal Article Reviewer, Pro Bono, International. (September 2010 - Present).
- 7th International Conference on Quantum Dots 2012, Judge for the best student/postdoc poster presentation, Santa Fe, New Mexico, USA, Appointed, Pro Bono, Selection of two award winners. (May 2012).
- Department of Energy Graduate Fellowship Program, Reviewer, Pro Bono, Ranking of graduate student proposals. (February 2012 - March 2012).
- Physical Review B (2), Physical Review Letters (1), ACS Nano (1), Journal of Applied Physics (1), Journal Article Reviewer, Pro Bono, International. (July 2009 - August 2010).
- APS March Meeting 2010, Session Chair, Portland, Oregon, USA, Pro Bono. (March 2010).
- Physical Review B (1), Physica E (2), Nano Letters (1), Journal Article Reviewer, Pro Bono, International. (July 2005 - June 2009).
- APS March Meeting Sorting Meeting, Abstract sorter, College Park, MD, USA, Pro Bono. (December 2008).
- APS March Meeting Sorting Meeting, Abstract sorter, College Park, MD, USA, Pro Bono. (December 2006).
- APS March Meeting Sorting Meeting, Abstract sorter, College Park, MD, USA, Pro Bono. (December 2005).

Professional Development

- Tutorial, "Digital Measures," UCM, Merced, CA. (July 2010).
- Conference Attendance, "APS March Meeting 2010," The American Physical Society, Portland, Oregon. (March 2010).
- Workshop, "Entanglement beyond the optical regime," Office of Naval Research, Orange, CA. (February 2010).

Research in Progress

- "Long-range coupling between quantum dot molecules" (On-Going)
Development of long-range and large-scale coupling mechanism between quantum dot molecules, which is independent of the typically large inhomogeneity of QDs.
- "Single Phonon Transport Between Quantum Dots" (On-Going)
Fundamental study of heat transport between zero dimensional nanostructures by optical means.
- "Vortex-induced Quantum dots" (On-Going)
Generation and fundamental study of highly homogeneous zero dimensional states by using superconductor-semiconductor hybrid structures.

TEACHING

Teaching Experience

University of California, Merced

Spring, 2012

- PHYS 105, Analytic Mechanics Core. (Spring 2012)
- PHYS 196, Upper Division Undergraduate Research Thesis. (Spring 2012)
- PHYS 293, Physics Colloquium. (Spring 2012)
- PHYS 295, Graduate Research. (Spring 2012)

Fall, 2011

- PHYS 195, Upper Division Undergraduate Research. (Fall 2011)
- PHYS 237, Quantum Mechanics I. (Fall 2011)
- PHYS 293, Physics Colloquium. (Fall 2011)
- PHYS 295, Graduate Research. (Fall 2011)

Summer, 2011

- PHYS 195, Upper Division Undergraduate Research. (Summer 2011)

Spring, 2011

- PHYS 105, Analytic Mechanics Core. (Spring 2011)
- PHYS 295, Graduate Research. (Spring 2011)

Fall, 2010

- PHYS 237, Quantum Mechanics 1. (Fall 2010)
- PHYS 295, Graduate Research. (Fall 2010)

Spring, 2010

- PHYS 295, Graduate Research. (Spring 2010)
- PHYS 299, Directed Independent Study. (Spring 2010)

Fall, 2009

- PHYS 237, Quantum Mechanics 1. (Fall 2009)
- PHYS 292, Journal Club. (Fall 2009)
- PHYS 295, Graduate Research. (Fall 2009)
- PHYS 299, Directed Independent Study. (Fall 2009)

Other

- Guest Lecture, (April 8, 2010).
Lecture on quantum dots in the Condensed Matter Physics (PHYS-241-01) in Spring 2010
- Seminar, (February 25, 2010).
Seminar on Hall effect and Landau levels in a group meeting of Raymond Chiao's group
- Workshop, (February 7, 2010 - February 12, 2010).

Directed Individual/Independent Study

- January 2010 - May 2010, Robert Campos, Advisor

Doctoral Candidacy Committee

Yashwant Verma, Member

June 2012 - Present, Cameron Jennings, Advisor

August 2011 - Present, Cyprian Czarnocki, Advisor

August 2011 - Present, Jose Jussi Amaral, Co-Advisor Co-Advised with Prof. Ghosh

August 2009 - Present, Mark Kerfoot, Advisor

August 2010 - July 2012, Robert Campos, Advisor After PELP student notified me that on 7/10/2012

Doctoral Committee

February 2012, Somnath Ghosh, Member

Undergraduate Research Supervision

Davis Lu, Advisor COINS intern 2012

June 2012 - Present, Randall Babaoye, Advisor COINS intern 2012

March 2012 - Present, Qianting Chen, Advisor COINS inter Summer 2012

March 2012 - Present, Shawn Bellosa, Advisor COINS intern 2012

March 2012 - Present, Sophia Yaksic, Advisor COINS intern 2012

October 2011 - Present, Marcus Bell, Advisor

October 2011 - Present, Youstina Gad, Advisor COINS intern 2012

October 2010 - Present, Alexandra Elfers, Advisor

August 2011 - May 2012, Cameron Jennings, Advisor

June 2011 - August 2011, Jonathan Lipscomb, Advisor

SERVICE

Department Service

Chair, PhD Committee, Leily Kiani. (June 2012 - Present).

Chair, PhD Committee, Chris Ferri. (January 2012 - Present).

Co-Coordinator, Undergraduate Physics Committee. (August 2011 - Present).

Member, PhD Committee, Bong Soo Kang. (2011 - Present).

Coordinator, Strategic Investment Faculty Hire Proposal for Physics & Chemistry. (January 2011 - Present).

Organizer, Physics & Applied Math Seminar Series. (December 2010 - Present).

Member, Physics graduate affairs committee. (September 2010 - Present).

Member, PhD Committee, Luis Martinez. (July 2010 - Present).

Member, PhD Committee, David Ando. (2010 - Present).

Member, PhD Committee, Ronald Pandolfi. (2010 - Present).

Member, Physics and Chemistry Executive Committee. (2010 - Present).

Member, PhD Committee, Somnath Ghosh. (2010 - February 2012).

Member, PhD Committee (defense), Korana Burke. (2010).

School/College Service

Member, SNS Space Committee. (February 2012 - May 2012).

**APPENDIX C – ASSESMENT PLAN, CORE COURSE SYLLABI,
TEACHING PLAN**

Program Learning outcomes

Graduates of the Physics PhD program will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Have the experimental, theoretical, and/or computational skills** necessary to conduct and lead independent responsible research and contribute to knowledge in their chosen subfield.
- 3) **Identify new research opportunities**, which may cross traditional discipline boundaries, plan effective strategies for pursuing these opportunities and conduct research that makes a new contribution to knowledge in their chosen subfield of physics and solve important problems in society.
- 4) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, including in a classroom setting to expert and non-expert audiences. This includes the publication of original research results in peer reviewed scientific journals.

Graduates of the Physics Masters program (type II) will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Be proficient in professional skills** necessary to lead a productive career in physics or a related career including ethical conduct in research.
- 3) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, to expert and non-expert audiences.

Curriculum Map (Ph.D. program)

(I = introductory graduate level, D = developed, M = mastery; where a range is given, higher levels of achievement are expected from more advanced students)

PLOs	1 Fund. knowledge	2 Communi- cation	3 Ethics	4 Technical proficiency	5 New research
Quantum Mechanics I PHYS237	M	I			
Electrodynamics PHYS 210	M	I			
Classical Mechanics PHYS205	M	I			
Statistical Mechanics PHYS 212	M	I			
Quantum Mechanics II PHYS238	M	I			
Biophysics PHYS204	M	I			
Condensed Matter PHYS 241	M	I			
Electrodynamics II PHYS211	M	I			
Nonlinear dynamics	M	I			
Physics colloquium PHYS293	I-M		D-M	I-M	I-M
PHYS 295 - research	I-M	I-M	D-M	I-M	I-M
Quantum Optics PHYS248	M				
Particle physics PHYS259	M				
Special topics PHYS292	M				
Responsible conduct in research - QSB 294		I	M		
Teaching Assistant		D			
Prelim exam	I				
Qualifying exam	D-M	D	D	D	I
Annual committee meeting	I-M	D-M	M	D-M	D-M
Dissertation	M	M	M	M	M

Items in **bold face** are required for the PhD

Curriculum Map (M.S. program, type II)

(I = introductory graduate level, D = developed, M = mastery; where a range is given, higher levels of achievement are expected from more advanced students)

PLOs	1 Fund. knowledge	2 Communi- cation	3 Ethics
Quantum Mechanics I PHYS237	M	I	
Electrodynamics PHYS 210	M	I	
Classical Mechanics PHYS205	M	I	
Statistical Mechanics PHYS 212	M	I	
Quantum Mechanics II PHYS238	M	I	
Biophysics PHYS204	M	I	
Condensed Matter PHYS 241	M	I	
Electrodynamics II PHYS211	M	I	
Nonlinear dynamics	M	I	
Physics colloquium PHYS293	I-M		D-M
Quantum Optics PHYS248	M		
Particle physics PHYS259	M		
Special topics PHYS292	M		
Responsible conduct in research - QSB 294		I	M
Teaching Assistant		D	
Prelim exam	I		
Annual committee meeting	I-M	D-M	M
Comprehensive exam	M	M	M

Items in **bold face** are required for the Masters degree

Physics Assessment plan for the PhD Degree

PLO #1: Fundamental knowledge

Direct Evidence: Grades in required courses, Performance on Ph.D. qualifying exam as assessed via rubric; content of Ph.D. dissertation as assessed via rubric; student progress summaries from annual committee meeting.

Indirect Evidence: Exit survey and alumni survey; grades earned in emphasis track course work
Year to be Assessed: AY 2013-2014

Participants: Educational Policy Committee (EPC) or graduate executive committee; members of faculty committees; students graduating from the program; alumni.

Process: Faculty committee members will be asked to rank each Ph.D. dissertation and each Ph.D. qualifying exam as Excellent, Good, Fair, or Poor in this regard. EPC will review these qualitative ratings along with all student grades in emphasis track graduate courses. Graduating students and alumni will be asked to subjectively rate their own graduate training in fundamental knowledge and where improvements might be made. As needed, EPC will propose changes or additions to existing courses or their prerequisites.

Targets: 100% Fair or better on qualifying exam (Poor is considered failing at the qualifying exam stage); 100% Good or better on dissertation.

PLO #2: Technical proficiency and responsible research conduct

Direct Evidence: Performance on Ph.D. qualifying exam; content of Ph.D. dissertation. Performance in the QSB 294 “Responsible Conduct of Research” course. Appropriateness and completeness of citations in Ph.D. dissertation; understanding of ethical issues evidenced in annual committee meeting

Indirect Evidence: Exit survey and alumni survey.

Year to be Assessed: AY 2014-2015

Participants: Members of faculty committees; EPC; students graduating from the program; instructor in QSB 294; alumni.

Process: Faculty committee members will be asked to rate each Ph.D. dissertation and performance on qualifying exams as Excellent, Good, Fair, or Poor in this regard. Graduating students and alumni will be asked to subjectively rate the technical training they received in graduate school. EPC will review and, as needed, propose changes to student mentoring and expectations at annual committee meetings including ethical conduct of research considerations if necessary.

Targets: 100% Fair or better at qualifying exam (Poor at this stage is considered non-passing), 100% Good or better on dissertation.

PLO #3: New contributions to knowledge

Direct Evidence: Candidacy exam and content of Ph.D. dissertation.

Indirect Evidence: Publications, patents, and citations.

Year to be Assessed: AY 2015-2016

Participants: Members of faculty committees; group chair and program staff; EPC.

Process: Faculty committee members will be asked to rank each Ph.D. dissertation as Excellent, Good, Fair, or Poor in this regard. Group chair with the assistance of program staff will perform ISI or related search to compile a list of publications, patents, and citations of all current students and those awarded degrees in previous years. EPC will review and, as needed, propose changes to student mentoring and expectations at annual committee meetings.

Targets: Dissertation research of 100% of graduates will be judged as Fair or better (if Poor, dissertation is unacceptable).

PLO #4: Communication

Direct Evidence: Oral communication: annual committee meeting, and candidacy exam.

Written communication: composition of dissertation as assessed via rubric.

Indirect Evidence: Exit survey and alumni survey.

Year to be Assessed: 2016-2017

Participants: Members of faculty committees; EPC; students graduating from the program; alumni.

Process: Faculty committee members will be asked to rate each Ph.D. dissertation and each annual committee meeting as Excellent, Good, Fair, or Poor in this regard. Graduating students and alumni will be asked to subjectively rate their own training in communication and suggest improvements. EPC will review and propose changes as needed to the ethics and communication or seminar courses.

Targets: 100% Fair or better in oral communication at candidacy exam and in written communication on dissertation.

Physics Assessment Plan for Masters Degree (type II)

PLO #1: Fundamental knowledge

Direct Evidence: Performance in comprehensive exam.

Indirect Evidence: Exit survey and alumni survey; grades earned in emphasis track course work

Year to be Assessed: 2013-2014

Participants: Educational Policy Committee (EPC) or graduate executive committee; students graduating from the program; alumni.

Process: Faculty committee members will be asked to assess the student in a comprehensive exam as Excellent, Good, Fair, or Poor. EPC will review these qualitative ratings along with all student grades in emphasis track graduate courses. Graduating students and alumni will be asked to subjectively rate their own graduate training in fundamental knowledge and where improvements might be made. As needed, EPC will propose changes or additions to existing courses or their prerequisites.

Targets: 100% Fair or better on comprehensive exam (Poor is considered failing).

PLO #2: Professional and ethical skills

Direct Evidence: Performance in the QSB 294 “Responsible Conduct of Research” course.

Appropriateness and completeness of citations in thesis if completed; understanding of ethical issues evidenced in comprehensive exam.

Indirect Evidence: Exit survey and alumni survey.

Year to be Assessed: AY 2014-2015

Participants: Members of faculty committees; EPC; students graduating from the program; alumni.

Process: Faculty committee members will be asked to rate each Masters thesis as Excellent, Good, Fair, or Poor in this regard. Graduating students and alumni will be asked to subjectively rate the technical training they received in graduate school. EPC will review and, as needed, propose changes to student mentoring and expectations at annual committee meetings.

Targets: Thesis research of 100% of graduates will be judged as fair or better (if Poor, thesis is unacceptable).

PLO #3: Communication

Direct Evidence: Oral communication: performance in M.S. comprehensive exam and in annual committee meeting (rate excellent, good or fair using rubric). Written communication: Master’s thesis as assessed by rubric if completed.

Indirect Evidence: Exit survey and alumni survey.

Year to be Assessed: AY 2016-2017

Participants: Members of faculty committees; EPC; students graduating from the program; alumni.

Process: Faculty committee members will be asked to rate each Master’s thesis (if completed) and each annual committee meeting as Excellent, Good, Fair, or Poor in this regard. Graduating students and alumni will be asked to subjectively rate their own training in communication and suggest improvements. EPC will review and propose changes as needed to the ethics and communication or seminar courses.

Targets: 100% good or excellent in oral comprehensive exam

Physics 212
Statistical Mechanics
Spring 2012

Instructor

Prof. Ajay Gopinathan

Office: SE1 352

email: agopinathan@ucmerced.edu

URL: <http://faculty.ucmerced.edu/agopinathan>

Office hours: Mon, Wed: 2:30-3:30 p.m.

Textbooks

Required: *Introduction to Modern Statistical Mechanics*, David Chandler (Oxford, 1987)

Other sources: *MIT Open Courseware*, 8.333 Statistical Mechanics I (ocw.mit.edu)

Class Times

Lecture: Monday, Wednesday: 9:30-10:45 a.m.; Classroom Building 282

Introduction and Objectives

Statistical Mechanics forms one of the core foundations of modern natural science and plays a significant role in cutting edge research in a variety of fields ranging from condensed matter physics and materials science and engineering to molecular biology and biophysics to chemical structure and dynamics and even to high energy physics and astrophysics.

This course aims to give students a deep understanding of the fundamental principles of statistical mechanics, introduce them to state-of-the art theoretical techniques of statistical mechanics and to communicate the excitement of cutting-edge research in a variety of fields where statistical mechanics plays a crucial role.

Student Learning Outcomes (SLO's)

At the end of the course :

1. The student should have a firm grasp of fundamental principles of statistical mechanics. Students should be able to simplify and model real systems in a physically reasonable and tractable fashion.
2. Utilize the formal and mathematical techniques learnt in the course to predict various properties of the system at hand.

3. Be able to then verbally and in writing communicate what their predictions mean in a real laboratory or natural setting.
 4. They should also have a good understanding of the various theoretical and computational techniques of statistical mechanics and be able to identify relevant techniques to address specific physical problems.
 5. They should also have gained the ability to follow current research and literature in a variety of fields where statistical mechanics has a central role.
- Table 1 summarizes how various components of the course address different SLO's.

Course component	SLO's
Lectures	1,2,4
Homework	1,2,3,4
Exams	1,2,3,4
Team Project	1,2,3,4,5
Team Problem Sessions	1,2,3,4,5

Table 1: Components of the course and how they contribute to the SLO's

Relation to programmatic learning objectives

Physics Graduate Programmatic Learning Outcomes (PLO's):

Graduates from the Physics Ph.D. program will have demonstrated the following learning outcomes.

- 1) Strong fundamentals in physics.

Course component	PLO's
Lectures	1,2,3
Homework	1,2,3
Exams	1,2,3
Team Project	1,2,3,4,5
Team Problem Sessions	1,2,3,4,5

Table 2: Components of the course and how they contribute to the PLO's

- 2) Broad academic outlook.
- 3) Analytical and Reasoning skills.

4) Communication and Teamwork Skills.

5) Research Proficiency

Table 2 summarizes how various components of the course address different PLO's.

Homework

Homework is a very important part of the course. Spending time on the homework assignments will greatly improve your understanding of the course material and help prepare you for exams. The assignments will be a combination of problems from the textbook and others specially designed for this course. The full problem sets will be posted on the class website. Late submissions will not be entertained.

You are encouraged to work in groups on the assignments. However all work that you turn in must be *your own*. You will be graded not only on the answer but on the work leading upto it. So please make a genuine attempt to work on all problems, even if you cannot get to the final answer.

Team Project

You will be divided into teams which will involve 3 to 4 students. Each team will select a research project that will involve formulating a problem, literature surveys and developing computational and/or analytical techniques to address the problem. You will be expected to turn in a term paper based on your research. There will also be a final symposium where the projects will be presented. Please consult the instructor to choose an appropriate project topic. This will count toward your final grade.

Team Problem Sessions (discussion)

You will be divided into teams as for the project. Each team will select a preassigned problem to solve and present the solution at discussion section.

Exams

There will be one midterm exam and one final. No make-up or early exam requests will be entertained. If you miss an exam due to illness, please bring a doctor's note and talk to the instructor. Your score will then depend on the rest of your course work.

Grading

The distribution of your grade will be as follows:

Final exam : 25 %
Midterm exam : 25 %
Homework : 25 %
Project : 25 %

Academic Honesty

All students are expected to abide by UC Merced's Academic Honesty Policy. Collaborating is allowed on assignments. However, you are encouraged to first try as hard as possible to do all the problems on your own before discussing with others. *Collaboration does not mean copying another student's work.* All work submitted by a student for credit must be the student's own work.

You are encouraged to study together and to discuss information and concepts covered in lecture with other students.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way.

For more details on the academic honesty policy please refer to the appropriate section under student life on the UC Merced homepage.

Accommodations for Students with Disabilities:

The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

Co-listing with PHYS 112

This course could be co-taught with the upper division undergraduate course PHYS 112: Statistical Mechanics. The delivery of this will be aided by the textbook which specifically targets both upper-level undergraduates and beginning graduate students. Different sets of homework and exams at different difficulty levels will be prepared for the undergrad and grad students. In addition there will be a higher expectation of originality and rigor in the projects assigned to graduate students.

Syllabus

Week	Lecture Topic	Chapters
1	Probability theory, characteristic functions, central limit theorem	LN
2	Foundations, microstates, ensembles, entropy, temperature	3, LN
3	Microcanonical and Canonical Ensembles	3
4	Generalized Ensembles, Legendre transformations	3,1,2
5	Photon and Phonon gases	4
6	Bose-Einstein, Fermi-Dirac statistics	4
7	Midterm	-
8	Ideal Classical Gases	4
9	Ising Model	5
10	Symmetry breaking	5
11	Mean field theory	5
12	Renormalization Group Theory	5
13	Monte Carlo Methods	6
14	Classical Fluids	7
15	Elements of non-equilibrium statistical mechanics	8

Table 3: LN: Lecture notes.

Phys 205: Classical Mechanics
University of California, Merced
Fall 2012

Instructors: Prof. Michael Scheibner
Office: S&E 378
Phone: 209-228-4873
Email: mscheibner@ucmerced.edu
Phys 237 office hours: W 10:00am-noon

Class times:

Lecture: **M** 4:30pm-5:45pm; **every 2nd W** 4:30pm-6:50pm; CLASSRM 274

Discussion: **every second W** 4:30pm-6:50pm; CLASSRM 274

Introduction:

In classical mechanics we aim to describe and predict the motion of objects, where this is done in terms of mathematical equations. So far these equations have been determined mainly empirically, based on some experimental observation. An example is determining the time it takes an object to drop to the ground from a certain height. In this course we will develop a deeper understanding of the physical processes based on first principles and mathematical methods. As we progress we will get to know a more and more abstract yet insightful description of classical mechanics. The concepts we will discuss in this course will be useful also for other physical theories, like E&M or statistical mechanics. In particular it will serve as a prelude to quantum mechanics.

Course goals:

It is presumed that all students in this course have full undergraduate familiarity with the basic concepts and techniques of classical mechanics and mathematics.

This course is designed to help you:

- Expand on your foundation and explore advanced problems in mechanics.
- Learn alternative approaches to Newtonian Mechanics, and delve into concepts that go beyond the daily observations.
- Develop the problem-solving skills required to succeed in physics.

Student Learning outcomes: Learning outcomes provide measureable ways to determine how well you have mastered the course material, and they're designed to incorporate various levels of expertise with course material. So, by the end of the course, you should be able to:

1. explain and apply principles of classical mechanics to advanced physics problems.

2. analyze advanced physical systems with classical mechanics models presented in the course and support your conclusions verbally, mathematically, and in writing.
3. publicly present and justify your approach towards the solution of a problem.

Subject matter:

This course is a one semester course. Below is a tentative schedule and outline of what we will likely cover in this semester, time permitting (subject to change).

Week	Monday	Topic	Wednesday	Topic
1	08/27:	Intro	08/29:	Lagrange I
2	09/03	No Class	09/05	Lagrange II/III
3	09/10	Hamilton I	09/12	Disc. HW1
4	09/17	Hamilton II	09/19	Hamilton III/ H-J I
5	09/24	H-J II	09/26	Disc. HW2
6	10/01	Central Forces	10/03	Collisions/ RB I
7	10/08	Rigid Body II	10/10	Disc. HW3
8	10/15	Rigid Body III	10/17	(Out of town)
9	10/22	ODCS I (S1)	10/24	Disc. HW4
10	10/29	OCDS II (S2)	10/31	ODCS III (S3), SR I (S4)
11	11/05	SR II (S5)	11/07	Disc. HW5
12	11/12	No Class	11/14	SR III (S6) Geo I (S7)
13	11/19	Geo II (S8)	11/21	Disc. HW6
14	11/26	Geo III (S9)	11/28	NLDC I & II (S10,11)
15	12/03	NLDC III (S12)	12/05	NLDC IV (S13),Disc. HW7

Key: H-J: Hamilton-Jacobi, ODCS: Oscillations in Discrete and Continuous Systems, SR: Special Relativity, Geo: Geometric Aspects of Mechanics
 NLDC: Non-Linear Dynamics & Chaos

Text and course materials:

You are expected to read up on the topics discussed in class independently (without reading assignment). You are encouraged to find yourself other textbooks on the course material and to read them, as well as share what you have learned. This helps everyone in class to obtain a broader insight in the studied matter, and will benefit you in getting used to do independent literature search.

Good texts on classical mechanics are:

- *Mechanics*, (3rd Edition) Volume 1 (Course of Theoretical Physics) by L. D. Landau and E.M. Lifshitz
- *Classical Mechanics: Systems of Particles and Hamiltonian Dynamics* by Walter Greiner
- *Mechanics: From Newton's Laws to Deterministic Chaos* (Graduate Text) by Florian Scheck
- *Mechanics. Lectures on Theoretical Physics Volume 1* by Arnold Sommerfeld (out of print)

- *Analytic Mechanics* by Fowles & Cassiday (upper level undergrad)

Homework:

Every second week you will receive a set of homework questions. These problem sets are designed to be both challenging and rewarding. They are critical to honing your understanding and proficiency with the techniques of classical mechanics. Homework will be made available on the [UCM Crops](#) site by the Friday of a discussion week, and it will be due in the discussion session on the second Thursday after that. If for some reason you can't attend the discussion session please send your homework electronically **before** the discussion session. Failure to do so will result in the loss of the points for the particular homework set.

You are strongly encouraged to work together in teams on solving the problem sets. Make use of working in teams to increase your understanding of the subject matter, improve your verbal and presentational skills. In order to train your problem solving skills you are also strongly encouraged to try to solve the problems first on your own before you discuss it in a team with others.

Discussion:

The purpose of the biweekly discussion sections is primarily for you to present and discuss solutions to the homework problems. At the beginning of each session you are asked to indicate on a sign-up sheet which of the problems you can present at the board. For each problem you mark you will receive the number of points assigned to the problem. The instructor will pick a student from this sign-up sheet who then presents her/his solution to the class. If you falsely (intentionally or unintentionally) indicate that you can present a solution to a problem you will lose all points for this week's homework set. Not being able to present a solution means that you can't give a logic explanation for why you make a certain step in your solution. Note, it is not expected that you present a perfect solution. The points will enter the grade as outlined below.

The purpose of these oral presentations is to give you some feedback on your solution and thought processes, and to give you some practice in presenting in front of your peers and public speaking.

Term Project (Lecture):

No matter which career path you will be taking at some point you will have to present and explain your own or someone else's novel ideas to an audience. The audience may be your peers, your future boss, a funding source or your customers. Hardly ever will they make you take an exam. Therefore you will prepare and give a full one hour lecture on a subject matter related to advanced classical mechanics.

Students will be assigned to one of four topics, rigid body, special relativity, continuous systems, and non-linear dynamics. Each topic is to be covered in about three hours of lecture. That means about three students will work as a team on one topic in order to provide a coherent continuous story to the rest of the class. The assignments will be made after the add/drop deadline. Topics will be assigned randomly.

Your grade for the lecture presentation will be based to 50% (12.5% of total grade) on the instructor's evaluation and 50% (12.5% of total grade) on the evaluation of your classmates (a score sheet will be provided). You will also be required to hand in your lecture notes/material. This will take the place of a term paper. The notes should be clear and legible in a way that someone else could give the lecture. The notes will make up 25% of your grade.

Two weeks prior to your presentation meet with me during office hours (or in case of a time conflict schedule a meeting with me)

Grading:

Your grade will be based on the points you accumulated on the homework sets (50%), your lecture presentation (25%) and corresponding lecture notes of your lecture (25%). A comprehensive final exam (worth a maximum of 10%) is being offered upon request if a student wants to improve their grade.

Grades will be given using the approximate framework: A: 100-90%, B: 90-80%, C: 80-70%, D: 70-60%. The flavor of letter grade (+, even, -) will be determined when final grades are assigned.

To prepare for an exam you should review the homework problems. In the exams you will be asked to discuss one of the homework problems. In addition you will be asked to discuss new problems, not yet discussed in class, but which are solvable with the concepts and tools you will have learned so far. Thus your performance will be evaluated according to how well you are able to *reproduce, apply, and transfer* the material and physical concepts covered in this course.

All exams will consist of qualitative and quantitative problems, based on homework and lecture material. A combination of familiar and new problems will test your command of the course material. I will give you more information about the timing and content of the final exam as the date approaches. *There will be no make-up exams or early exams!* If you are sick during an exam or homework session, please bring a note from your doctor verifying your illness. Your course grade will then be determined by the rest of your course work.

Exam dates:

Final: Friday Dec. 14th 3pm-6pm (or tbd if oral) - covers all material discussed in the course.

Exam regrading:

- If your score was tabulated incorrectly, please let me know and I'll correct it. *Once you leave the room after picking up your exam, you may not request a correction.*
- If you believe a problem has been unfairly graded I will regrade your exam. Write a note on the front explaining why you want a regrade. Please note that the entire exam will be regraded, which may result in a higher score, a lower score, or no change. *Once you leave the room after picking up your exam, you may not request a regrade.*

UCM Crops:

The UCM Crops site "[S11-PHYS 205 001](#)" will be used for periodic course announcements, and for the distribution of weekly homework sets, solutions, and class notes. You should make sure that you can access this site and that you are familiar with its contents. **Warning: The Crops site may generate its own letter grade throughout the semester. However, you should pay no attention to any letter grade that is reported on Crops, except for the final course grade.**

Student Services

Both myself and UC Merced are committed to making my course accessible to all students, including students with limited mobility, impaired hearing or vision, and learning disabilities. Students with special needs should contact Brad Neily (bneily@ucmerced.edu) at UC Merced Disability Services as early as possible in the semester so that appropriate arrangements can be made. Please also let me know so that I can help you to meet your learning expectations.

Academic Integrity

- **Each student in this course is expected to abide by the University of California, Merced Academic Honesty Policy.**
- Any work submitted by a student in this course for academic credit will be the student's own work. Collaborating is allowed in discussions, and on homework. (See the relevant sections above.)
- You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
- During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.
- Full policy online. Go to studentlife.ucmerced.edu, click on Student Judicial Affairs, click on Academic Honesty Policy.

Phys 237: Quantum Mechanics I
University of California, Merced
Fall 2011

Instructor: Michael Scheibner
Office: S&E 378
Phone: 209-228-4873
Email: mscheibner@ucmerced.edu
Phys 237 office hours: T 1:00pm-3:00pm

Class times:

Lecture: **M** 6:00pm-7:45pm; **W** 6:00pm-6:45pm; CLASSRM 262

Discussion: **W** 6:50pm-7:45pm; CLASSRM 262

Introduction:

The beginning of the quantum age can be pin pointed to the year 1901 where Max planck published his quantized theory of the black body radiation. The early history of quantum mechanics following Planck's theory is a rather messy affair, with new ideas introduced and folded into the evolving theory over a period of several decades. By the latter half of the 1920's many other important contributions have been made including the introduction of Heisenberg's matrix mechanics, Schrödinger's wave equation, Bose-Einstein and Fermi-Dirac statistics, and the so-called Copenhagen interpretation of quantum theory. Even after the consolidation of quantum mechanics in the 1920's, the subject has evolved considerably with the introduction of new ideas that are now central to the theory, including the Feynman path integral in the 1940s, Bell's inequality (1964), and the introduction of gauge symmetries, which form the foundation of the current standard model. This list is by no means complete, and quantum mechanics continues to be an active field of research today, considerably revitalized by recent advances in quantum information experiments and theory.

Course goals and expectations (Learning outcomes):

It is presumed that all students in this course have an undergraduate familiarity with the basic concepts and techniques of quantum mechanics. Given the complicated history of quantum mechanics, however, it is perhaps not surprising that one's own personal introduction to quantum theory can seem at times to be a jumbled collection of disjoint rules and concepts. It is the objective of this course to provide a foundation:

- for your understanding of quantum theory,
- that will allow you to view disparate quantum effects and processes within a single consistent and unified framework
- that will allow you to make the connection between quantum theory and the experimental reality.

By the end of the semester you will be able to

1. articulate in oral and written forms, and revise as necessary, your intellectual strategy for solving problems involving quantum mechanics, including the identification of foundational principles and selection of appropriate mathematical and physical tools.
2. use appropriate oral and written presentation skills to communicate problems and solutions to a knowledgeable audience so that they are able to follow the solution trajectory sufficiently well to provide a constructive critique.

Rather than following the historical development, we will build up the theory of quantum mechanics within an axiomatic framework. We will also build up the necessary mathematical tools for discussing and effectively applying quantum theory to various physical situations.

Faced with a question about some quantum phenomenon or process in your research, this course will help you address this question by going back to first principles and progressing logically forward with the appropriate mathematical and physical tools.

Subject matter:

This course is the first in a two semester series. Below is a rough outline of what we will likely cover in the first semester, time permitting.

- Mathematical background (1 Week) – linear algebra, Hilbert spaces, operators, bra-ket notation
- Postulates of quantum mechanics (1 week) – axiomatic foundations of quantum mechanics, quantum measurements, observables
- Position and momentum representations (1 week) – classical and quantum translations, position and momentum operators, Schrödinger and Heisenberg pictures, wavefunctions, Uncertainty Principle, simple harmonic oscillator
- Path integrals (1 week) – Lagrangians in classical and quantum mechanics, Feynman formalism, semiclassical propagator, gauge transformation, Aharonov-Bohm effect
- Rotations and angular momentum (5 weeks) – classical and quantum rotations, spin and orbital angular momentum, spherical harmonics, NMR, addition of angular momenta, Clebsch-Gordon coefficients, Wigner-Eckart theorem.
- Symmetry (2 weeks) – parity, time-reversal, lattice translations, Bloch’s theorem and band structure
- WKB theory (1 week) – connection formulas, Bohr-Sommerfeld quantization
- Approximation methods – Time-independent perturbation theory, WKB-Theory, Hartree, Hartree-Fock (3 weeks)

Though this course is not focused on any particular area of physics, such as “condensed matter”, “particle”, or “atomic” physics, we will be delving into such areas at some level to illustrate the basic principles of quantum mechanics in realistic physical situations.

Text and course materials:

Modern Quantum Mechanics, revised edition, by J. J. Sakurai. We will primarily cover material from Chapters 1-5, plus supplemental material as necessary.

You are strongly encouraged to read other textbooks on the course material as well and share what you have learned in class. This helps everyone in class to obtain a broader insight in the studied matter, and will benefit you in getting used to do independent literature research.

Discussion sections:

The purpose of the weekly discussion sections is primarily for you to present solutions to the homework problems.

Homework:

Each week you will receive a set of homework questions. These problem sets are designed to be both challenging and rewarding. They are critical to honing your understanding and proficiency with the techniques of quantum mechanics. Homework will be made available on the [UCM Crops](#) site by Thursday each week, and it will be due in class on the following Wednesday.

Homework solutions are to be prepared in teams of three or four depending on the total enrollment in class. Solutions are to be presented by one person of a group to the other group(s), without help from the group that person belongs to. The respective other group is supposed to pay attention to the presenter, catch possible mistakes, give corrections, and point out alternatives. Each problem presented is worth 10 points. Each presenter earns the points for the other members in the group. Points are being deducted for mistakes, bad presentation (style/clarity), inability to explain the steps. The other group can earn points by giving corrections to mistakes.

Groups will be formed new after each exam. The points each person collects throughout the semester will count towards the course grade. You are allowed one free unexcused no show during the semester, at no penalty. Otherwise, homework turned in late will receive only half credit.

It is expressly forbidden to use any solution sets that may have been distributed in prior semesters of this course. (With enough sleuthing, you could probably track down old solutions sets, but you would be doing a tremendous disservice to yourself if you relied upon these.)

Grading:

Your grade will be based on two midterms (total 25%), a final exam (25%), and the homework problems (50 %).

To prepare for an exam you should review the homework problems. In the exams you will be asked to discuss one of the homework problems. In addition you will be asked to discuss new problems, not yet discussed in class, but which are solvable with the concepts and tools you will have learned so far. Thus your performance will be evaluated according to how well you are able to reproduce, apply, and transfer the material and physical concepts covered in this course. No team formation in exams.

Exam dates:

Midterm 1: Wednesday Sep. 21th (in class)

Midterm 2: Wednesday Oct. 26th (in class)

Final: Wednesday Dec. 14th 6:30pm-9:30pm (COB209)

UCM Crops:

The UCM Crops site “[F10-PHYS 237 001](#)” will be used for periodic course announcements, and for the distribution of weekly homework sets, solutions, and class notes. You should make sure that you can access this site and that you are familiar with its contents. **Warning: The Crops site may generate its own letter grade throughout the semester. However, you should pay no attention to any letter grade that is reported on Crops, except for the final course grade.**

Student Services

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Academic honesty

Students are expected to abide by the UC Merced academic honesty policy, which can be found on the Student Life website <http://studentlife.ucmerced.edu/> under the “judicial affairs” link. As mentioned above, you are encouraged to work together on learning the material in this class, including working together to understand the homework problems. However, all work that you turn in should be your own writeup, written in your own words. Furthermore, it is expressly forbidden to use any solution sets that may have been distributed in prior semesters of this course.

Physics 210 **ELECTRODYNAMICS** Fall 2012 Roland Winston

rwinston@ucmerced.edu <http://ucsolar.org> address: UC Solar at Castle (shuttle every hour)

Classroom 272 8AM – 9:50 AM

Text: Classical Electromagnetism

Jerrold Franklin Pearson/Addison Wesley 2005 ISBN 0-8053-8733-1

Recommended readable text: Classical Electricity and Magnetism 2nd edition, Panofsky and Phillips, Dover edition.(a user-friendly book)

Also: Classical Theory of Fields, Landau and Lifshitz (a beautiful classic text in physics)

SCOPE: From Electrostatics to Electromagnetic waves (~ first 10 Chapters of Franklin)

PLAN OF THE COURSE

Monday:

1. Hand in problems assigned previous Wednesday
2. Lecture on new material,
3. Go over Wednesday's Quiz
4. Go over problems assigned previous Wednesday

Wednesday:

1. Lecture on new material
2. Assign problems for following class
3. Short quiz (multiple choice, no notes, computers, tablets, calculators, phones, etc.

Weekly Quiz 25%, Weekly Homework 25%, Midterm 25%, Final Exam 25%

Topics:

Electrostatics

Potential theory

Green's Functions

Electrostatics in matter

Lagrange equations of motion in electromagnetic fields

The vector potential

Magnetostatics

Magnetostatics in matter

Time varying fields, Maxwell's Equations

Electromagnetic Plane waves

Electromagnetic waves in matter

Radiation

Dipole radiation

Radiation by an accelerating charge

Wave Guides and Cavities

APPENDIX D – LETTERS OF SUPPORT

APPENDIX E - POLICIES AND PROCEDURES AND GROUP BYLAWS

Physics graduate group policies and procedures

1.1 The mission and objectives of the physics graduate program

The mission of the Physics graduate program at UC Merced is to train our next generation of scientific leaders. Our graduates will be well prepared to conduct and communicate independent research at the knowledge frontier, advancing fundamental understanding of the world around us and using physics to solve important problems in society.

Program Learning outcomes

Graduates of the Physics PhD program will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Have the experimental, theoretical, and/or computational skills** necessary to conduct and lead independent responsible research and contribute to knowledge in their chosen subfield.
- 3) **Identify new research opportunities**, which may cross traditional discipline boundaries, plan effective strategies for pursuing these opportunities and conduct research that makes a new contribution to knowledge in their chosen subfield of physics and solve important problems in society.
- 4) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, including in a classroom setting to expert and non-expert audiences. This includes the publication of original research results in peer reviewed scientific journals.

Graduates of the Physics Masters program (type II) will:

- 1) **Possess a broad foundation** in the fundamentals of physics and a deep understanding of their chosen subfield, which will permit them to understand and critically evaluate current research.
- 2) **Be proficient in professional skills** necessary to lead a productive career in physics or a related career.
- 3) **Communicate** both fundamental concepts of physics and details of their own research effectively, in written and oral form, to expert and non-expert audiences.

2.1 Admissions Procedures and Requirements

All persons seeking admission to graduate standing must make formal application for admission through the Graduate Division's on-line application system. Applications are reviewed by the Admissions Committee, which makes recommendations on admission to Graduate Studies; the Dean of Graduate Studies makes final decisions on admission. The deadline for receipt of applications is January 15 for enrollment in the Fall semester. Applicants are encouraged to contact individual faculty members about their areas of research and teaching interests prior to applying.

Materials to be submitted:

- The complete official application form;
- The application fee;
- All official university/college/junior college transcripts;
- An official Graduate Record Exam (GRE) score report. Only the general tests are required, but the subject test in physics is also recommended;
- Three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher;
- Official score reports from the Test of English as a Foreign Language (TOEFL) if the applicant's native language or language of instruction is other than English.

The minimum requirement for graduate admission to UCM is a bachelor's degree, or any other degree or certificate which the Graduate Council accepts as equivalent, and a grade point average no lower than 3.0 on a 4.0 scale. This minimum will be waived only under circumstances where the applicant has demonstrated strong academic skills subsequent to their undergraduate studies. Performance on the GRE, accomplishments in undergraduate research, and letters of recommendation will also be evaluated as important determinants of an applicant's potential for success in graduate education.

Foreign students from non-English speaking countries are required to attain a minimum score on the TOEFL exam as required by UC Merced policy for admission to graduate programs. Students from non-English speaking countries will normally be interviewed by telephone by a member of the Admissions Committee in order to evaluate English proficiency.

2.2 General Requirements for Advanced Degrees

2.2.1 Residency

In accordance with SR 682 and 686, the minimum residency requirement for any advanced degree is two semesters. The minimum residency requirement for the Ph.D. degree is four semesters. Before advancement to candidacy Ph.D. students must be registered in regular University courses as a full-time student for at least two semesters. M.S. students must be registered as a full-time student for at least one semester before advancement to candidacy. M.S. students must be in residency for at least one semester after advancement to candidacy before conferral of the degree. For the purposes of determining residency, only the Fall and Spring semester will be counted; however, the summer semester may be counted in evaluating students on academic probation. Residency is established by satisfactory completion of at least 12 units of graduate coursework (including research) per term. Ordinarily, a graduate student shall not receive credit for more than 12 units of graduate courses in any semester. The physics graduate

group only accepts full time students. Exceptions will only be granted for students in the non-thesis Masters Degree program (Section V.B.) with the permission of the graduate group Chair, in consultation with the Executive Committee.

2.2.2. Scholarship

Graduate students must maintain at least a 3.0 grade-point average to be considered in good academic standing or to be awarded an academic graduate degree. A student whose cumulative graduate grade-point average falls below 3.0, or who is judged not to be making satisfactory progress toward the degree by his or her graduate advisor or faculty committee, will be placed on academic probation. The student will then be allowed a maximum of two semesters to make up the deficiencies and be returned to good academic standing. Otherwise, the student will be dismissed from the graduate program.

Specific scholarship requirements are as follows:

- 1 Only courses in the 100 and 200 series in which the student receives grades of “B” or above, or “S” may be counted in satisfaction of the requirements for advanced degrees. A course in which a student receives a “C” or “D” or lower cannot be used to satisfy the unit requirement for the degree but will count in determining the grade point average.
- 2 Candidates must maintain an average of at least three grade points per unit in all upper division and graduate courses elected during their residence as graduate students at the University of California. Students must maintain an average grade point of 3.0 for advancement to candidacy and conferral of the degree.
- 3 Courses graded “S/U” will not be counted in determining grade point averages.
- 4 Students must make satisfactory progress on their programs of study as determined by their graduate research advisor.

2.2.3. Faculty Committees For Advanced Degrees

The graduate advisor, normally in consultation with the student and other program faculty, recommends appointment of faculty members to advise on and supervise the student’s dissertation research as part of their examination committees. Final approval of the membership on these committees rests with the Dean of Graduate Studies.

Advanced degree committees in the Physics group normally consist of four members. One is the student’s major professor, two are other UC Merced faculty members in the group (one of whom is appointed as Chair), and one is from outside the group. This outside member may be a regular or adjunct faculty member from any UC campus or an individual from outside the University of California who has special expertise and qualifications. In this case, the graduate advisor should submit a brief statement indicating the appointee’s affiliation and title and how the prospective appointee has special expertise or qualifications that are not represented on the campus. In addition to the justification letter from the graduate advisor, a curriculum vitae and a letter from the proposed appointee indicating a willingness to serve must be submitted to the Dean of Graduate Studies for review and approval.

A student may opt to choose a major professor from outside of the physics group faculty (for example in applied math or chemistry). In such a case a nominal additional advisor from the physics group will be assigned in addition to the regular committee membership.

All members of the committee must be in attendance for Ph.D. qualifying and final examinations or Master's comprehensive oral examination (Plan II). All members of the committee must approve the Master's thesis (Plan I) or Ph.D. dissertation. If a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also be justified by a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The reason must be acceptable to the Dean of Graduate Studies.

2.3 Programs Of Study

2.3.1 Masters Degree (Type II)

Students may be admitted to the graduate program in Physics to work towards a Masters Degree (M.S.). Additionally, a Ph.D. student who has been in residence for at least two semesters, is in good academic standing, and has completed at least four of the core courses may petition the Admissions Committee to pursue a terminal M.S. degree. The recipient of a M.S. degree is understood to possess knowledge of a broad field of learning that extends well beyond that attained at the undergraduate level, but is not necessarily expected to have made a significant original contribution to knowledge in that field.

Students are normally admitted to the graduate program in Physics to work toward the Ph.D. degree. The Physics group has established the following requirements for the M.S. degree. Each M.S. student has a committee with at least three members.

- Complete at least two semesters of full-time academic residence (12 units minimum) at UC Merced;
- Pass the preliminary examination
- Complete at least 24 semester hours of upper-division and graduate course work with a cumulative grade-point average of at least 3.0. At least 16 semester hours must be from regular, letter-graded lecture or discussion courses, while the remaining 8 hours may be research or similar courses;
- Pass a comprehensive oral examination administered by the faculty committee. This examination will test the student's understanding of the main concepts in the field at the graduate level.

In addition, the M.S. program requires attendance at physics seminars and M.S. students are recommended to take research units (PHYS 295), attend journal clubs and group meetings to help fulfill their unit requirements. Many of the mandatory Physics courses are "letter grade only".

Graduate students should be aware that grades obtained of B- may land them in a state of unsatisfactory degree progress, as they must maintain an overall GPA of 3.0, and their semester GPA must not remain below 3.0 for two consecutive semesters. Graduate students should also be advised that S/U grades do not count towards GPA calculation by the registrar.

2.3.2 Doctor of Philosophy Degree

The Doctor of Philosophy degree is not granted by the University of California merely for the fulfillment of technical requirements, such as residence or the completion of fundamental courses. The recipient of a Ph.D. degree is understood to possess thorough knowledge of a broad field of

learning and to have given evidence of distinguished accomplishment in that field; the degree is a warrant of critical ability and powers of imaginative synthesis. The degree also signifies that the recipient has presented a doctoral dissertation containing an original contribution to knowledge in his or her chosen field of study.

The Physics group has established the following requirements for the Ph.D. degree:

- Complete at least four semesters of full-time academic residence (12 units minimum) at UC Merced;
- Complete the required courses with a letter grade of at least "B" in each course ("S" in seminar courses graded S/U);
- Serve as a teaching assistant for at least one semester;
- Pass a preliminary examination;
- Pass the oral Ph.D. qualifying examination;
- Present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field.

2.3.3. Selection of A Graduate Research Advisor

The heart of the Physics Ph.D. program is the completion of a piece of original scientific research leading to the preparation and defense of a Ph.D. thesis. To this end, each student should discuss research interests and possible Ph.D. projects with faculty in the group as early as possible, and select a graduate research advisor early during the first year of study. Selection of a graduate research advisor must be approved by the graduate group and must occur before the student's faculty committee can be constituted. The student and the graduate research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Interdisciplinary projects are encouraged, as are research collaborations with faculty or senior scientists outside UC Merced. Students will be assigned an initial advisor when they first enroll, unless the student has already chosen an advisor. This initial advisor will guide the student in their final choice of advisor.

2.3.4. Coursework Requirements

All Ph.D. students in the Physics group are required to take:

A. Core Course Requirements:

To be completed within the first four semesters.

- 1) PHYS 237 - Quantum Mechanics I
- 2) PHYS 210 - Electrodynamics
- 3) PHYS 212 - Statistical Mechanics
- 4) PHYS205 - Classical Mechanics

B. Electives:

To be completed at any time during the PhD

- 1) An elective from the physics courses
- 2) A second elective which may be chosen from any graduate level courses in the school of Natural Sciences of Engineering

Physics electives include advanced physics courses such as Quantum Mechanics II, Condensed Matter Physics, Biophysics and any other PHYS 2XX courses available. They can also include graduate courses from the applied math, BEST or chemistry groups as long as they are 3 units and taken as a graded class. Any elective must be at least 3 units and we require at least one elective be a course outside the student's primary research area, which can be selected by discussion with the student's thesis advisor or the graduate group advisor for Physics.

C. In addition, students must take 1 unit of BEST/QSB294 Responsible Conduct of Research, 4 semesters of Physics seminar.

Other courses may be added to these lists as fulfilling the requirements at any time, as designated by the physics faculty.

The preliminary exam

All students in the group are required to pass a written preliminary examination that tests undergraduate-level understanding of the fundamental concepts in the field. This exam is administered twice each year, at the beginning of Fall and Spring semesters. Students may elect to take the exam for the first time at the start of either the first or second semester in residence. The exam may be taken once each time it is offered, but must be passed no later than the start of the fourth semester (a maximum of three attempts). Students who have not passed the exam by the start of their fourth semester may be subject to dismissal.

If a student would like to attain a waiver for any of the courses above, the rules are:

1. No waiver will be granted unless the student has passed the preliminary exam.
2. For waivers regarding elective courses, a student can only ask for a waiver on one elective course. All core courses can be waived if competency is demonstrated.
3. For a waiver on any of the courses, the student will need to attain the waiver from the faculty member who taught the course most recently. The faculty member granting the waiver will only do so if the student can successfully complete an exam in the course. This exam can be given at any time at the faculty and student's convenience, any time of the year. The final decision to grant the waiver will be taken by the Graduate Division.

Course electives must be regular graduate courses (not research or independent study). Courses offered by other graduate programs may be taken as electives but require approval of the major professor. Requirements for formal course work beyond the minimum are flexible and are determined by the individual student's background and research topic in consultation with the major professor.

All Physics graduate students must successfully complete their core course requirements with a grade of S or B or better. A student may petition the graduate chair for a single B- grade to be accepted. Graduate students should be aware that grades obtained of B- may land them in a state of unsatisfactory degree progress, as they must maintain an overall GPA of 3.0, and their semester GPA must not remain below 3.0 for two consecutive semesters. Graduate students should also be advised that S/U grades do not count towards GPA calculation by the registrar.

2.3.5. Research Proposal

Before the qualifying exam, the student will provide to the degree committee a written document that describes his or her research topic, summarizes progress to date, and outlines what he or she

proposes to do, why it is relevant, and what will be learned. The format of the research proposal will be determined by the student in consultation with their adviser and committee; however the proposal must follow the format of a research proposal to a major funding agency in the student's area of research. The committee will review this document with the student and determine if the student has outlined a project that is appropriate for a Ph.D. If not, the student is given a month to rewrite the research plan. Once the research plan is approved the student may take the oral portion of the Qualifying Examination.

2.4. Ph.D. Qualifying Examination

All students in the Physics Ph.D. program are required to pass an oral qualifying examination before advancement to candidacy for the Ph.D. degree. Students are expected to take and pass the qualifying examination during their second year of graduate study unless they successfully petition the Educational Policy Committee to take it at a specific later date.

The qualifying examination may not be scheduled until the preliminary examination has been passed and the three core courses have been completed. The intent of this examination is to ascertain the breadth of a student's comprehension of fundamental facts and principles that apply in his or her major field of study. It will also determine the student's ability to think critically about the theoretical and practical aspects of the field. Accordingly, the examination should be focused on the student's field of research but may and should venture into other areas of scholarship that underlie or impinge on the thesis topic.

The examination committee is the same as the student's faculty committee. The major professor is a voting member of the committee, but will normally not participate in the examination except to provide technical clarifications as requested by the other members of the committee.

The date of the examination is arranged between the student and the committee chairperson. At least two weeks prior to the examination date, the student will provide to the committee a research proposal (typically approx ten pages) that describes his or her research topic, summarizes progress to date, and outlines what he or she proposes to do, why it is relevant, and what will be learned. The committee conducts the examination, and immediately thereafter submits the results of the examination to Graduate Division.

The committee members should include in their deliberations such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination. The student will be assigned either "Pass", "Conditional Pass" or "Fail". A unanimous decision is required for a "Pass". If not all members of the committee vote to pass, they must write a report explaining their decision and must inform the student of the reasons for the decision. A student who has not passed the examination may repeat the qualifying examination after a preparation time of at least three months. The examination must be held by the same committee except that members may be replaced, with the approval of the graduate advisor, for cause such as extended absence from the campus. Failure to pass the examination on the second attempt means that the student is subject to disqualification from further study for the doctoral degree.

2.5. Advancement To Candidacy

Upon successful completion of the examination, the student is given an application for advancement to candidacy by the examining committee chair. When it is filled out and signed by the graduate advisor and major professor, the student pays a candidacy fee and submits the form to Graduate Studies. Upon advancement to candidacy for the degree, the faculty committee is then charged to guide the student in research and in the preparation of the dissertation.

2.6. Publication Expectations

The final confirmation of the quality of a PhD dissertation is the ability to publish the research results in a peer-reviewed journal. The research field may influence the timing and work required to publish research results, making it difficult to define the number of publications required for each dissertation. For this reason, whether a student has made sufficient progress for the PhD will ultimately be determined by the student's advisor and thesis committee. The process of writing journal articles will be undertaken with the assistance and guidance of the student's research adviser. Published work should be presented to the graduate committee at the time of the student's thesis defense.

2.7 Dissertation And Final Examination

The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer reviewed journal. The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the faculty committee both the substance and the preparation of the dissertation well in advance of the planned defense date. Detailed instructions on the form of the dissertation and abstract may be obtained from the Graduate Studies office.

The student must provide a copy of the dissertation to each member of the faculty committee and allow each committee member at least four weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work is not adequate, the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the dissertation is ready to be defended (although minor errors or matters of controversy may still exist), the final examination date may be scheduled by the student in consultation with the committee. The date must be reported to the Dean of Graduate Studies, and one copy of the dissertation filed, no later than three weeks before the proposed date of the final examination.

The Ph.D. final examination consists of an open seminar on the dissertation work followed by a closed examination by the faculty committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached. At the conclusion of the examination, the committee shall vote on whether both the written dissertation and the student's performance on the exam are of satisfactory quality to earn a University of California Ph.D. degree. The student will be assigned either "Pass", "Conditional Pass" or "Fail". A majority is required for a pass. Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the dissertation (conditional pas). In this case, the committee will select one member, normally the major professor, who will be responsible for approving the final version of the dissertation that is submitted to Graduate Studies.

Time to degree and annual evaluation

The Physics group places no strict limits on the length of time a graduate student may remain in residence. However, it is normally expected that successful completion of the Ph.D. will require no more than six years. In order to ensure satisfactory progress toward the degree, each student must meet with his or her faculty committee for an annual review of progress at a mutually agreeable time prior to the first day of each Fall semester. At least three members of the committee, including the major professor, must be present. The committee will review the student's progress toward the degree during the past year and develop a time table, mutually agreeable among student, major professor, and faculty committee, for completion of the remaining requirements. The annual report of the committee will become part of the student's

record. Should the committee conclude that the student is not making satisfactory progress toward the degree, the student may be placed on academic probation.

2.9 Sample PhD Program

Table 7 - A sample timeline for the first 4 semesters of courses for a PhD student is shown below. A full description of the courses can be found in Section 5.

Fall 2013	Spring 2014	Fall 2014	Spring 2015
PHYS210 C (4)	PHYS237 C (4)	PHYS 238 (4)	PHYS248 (4)
PHYS205 C (4)	PHYS 212 C (4)		
PHYS 2XX (2)(writing)	PHYS 295 (3)	PHYS 295 (7)	PHYS 295 (7)
PHYS293 (1)	PHYS293 (1)	PHYS293 (1)	PHYS293 (1)

C = core class, brackets indicate units.

Table 8 - The physics group has developed the following sample guidelines for students to make good progress in the PhD program.

Year/semester	Activities
Year 1 (Semesters 1,2)	Learn about all research groups Take classes Pass preliminary exam (if applicable) Pick PhD advisor by end of second semester
Summer 1	Begin full time research with PhD advisor
Year 2 (Semesters 3,4)	Continue full time research with PhD advisor Take one class per semester if necessary Assemble faculty committee (beginning of third semester) Prepare for qualifying exam Schedule qualifying exam (during fourth semester) – defend PhD research proposal Apply for candidacy after passing qualifying exam (end of fourth semester)
Years 3	Conduct research Prepare manuscripts for publication Present work at a scientific conference; network for career
Years 4	Conduct research Continue publishing manuscripts Present work at a scientific conference; network for career.
Year 5 (Semesters 9,10)	Conduct research Present work at a scientific conference; network for career Declare candidacy for graduation (ninth semester) Defend and publish dissertation (tenth semester)

TEACHING AND RESEARCH ASSISTANTSHIPS AND STIPENDS

1. Newly admitted students will normally be supported as graduate TAs during their first two semesters in residence. After that, students will be supported as either TAs or GSRs depending on availability of TAs and the research advisor's funding situation.
2. New students who cannot be appointed as TAs because of limited English proficiency or lack of available TA positions may be appointed as GSRs for their first one or two semesters by mutual agreement of the student and the research advisor. The conditions of appointment will be the same as in #3 and #4 below. Normally all students will be required to TA for at least one semester as long as a suitable TA position is available. TA experience at other institutions could satisfy this requirement.
3. Graduate students serving as GSRs during the academic year will be appointed at 49.9% at the step for which the monthly stipend is most nearly equal to that for a first year TA in the Natural Sciences. There will be no additional or reduced pay during break periods.
4. Graduate students serving as GSRs during the summer will be appointed at the step determined in #3 above. The appointment will be 60% for students who have not yet been advanced to candidacy for the Ph.D. degree, and 70% for those who have been advanced to candidacy. Students are expected to spend the remainder of their time pursuing independent study toward the degree. GSRs do not accrue paid vacation time.
5. These policies should be revisited and revised as necessary on an annual basis.
6. Exceptions to these policies may be made at the recommendation of the student's research advisor, the graduate group chair, and the graduate dean.

Graduate Group in Physics
BYLAWS
Administrative Home: Graduate Division

Article I: Objective

The graduate emphasis in Physics is organized to establish and administer a program of instruction and research leading to the M.S. and Ph.D. under the auspices of the Interim Individual Graduate Program (IIGP) and in conformance with the regulations of the Graduate and Research Council and the Office of Graduate Studies at the University of California, Merced. The Graduate Group is responsible for establishing standards and requirements for the M.S. and Ph.D. degrees and certifying satisfactory completion of theses by candidates.

The Group function is to provide a focus for graduate training in physics, and related interdisciplinary fields, by facilitating the research interactions of graduate students and faculty.

Article II: Membership

Membership shall be limited to faculty who are actively involved in scientific inquiry and scholarship in physics and related fields. Membership may include both regular UC Merced faculty and adjunct faculty.

Members of the University faculty wishing to be appointed to the graduate faculty in the group as a voting **full member** must submit a written request to the Chair indicating their interest in participating in the group. This should be accompanied by a current CV. Materials will be evaluated by the Grad group membership committee for the appropriateness of the appointment to the group graduate faculty. The membership committee will make a recommendation to the group, and applicants will be admitted to the group if their application receives a majority vote from the full group.

Non-voting **affiliate members** are defined as faculty members whose primary graduate group home is outside of physics. They may be admitted to the physics graduate group following a majority vote by full members of the group after sending a request to join to the grad group chair and a copy of their CV. Affiliate members have the right to advise physics graduate students although a nominal full member will be assigned as an advisor to the student in addition. They also have the right to teach relevant physics graduate courses if approved by the educational policy committee.

Faculty will be expected to actively participate in the program. The faculty member is responsible for providing the membership committee with appropriate documentation of performance. Each member will be reviewed by the Committee every four years, and the Committee will make a recommendation to the group for continuation or termination of the individual's membership. Termination of a current member will require a two-thirds vote of the full group.

Article III: Organization and Administration

Due to the relatively small size of this program at its outset, the Executive Committee will assume the functions of certain standing committees, including membership, educational policy. Once the Group has a sufficient number of members, formal committee assignments into four standing committees (Executive, membership, educational policy and admissions) will be made.

The Executive Committee will consist of three members who will serve rotating terms of three years. The Group chair will serve as an *ex officio* member of the Committee. It will be the responsibility of the Executive Committee to prepare an annual slate of nominees that will be put before the membership for election to serve on the Executive Committee. Members can be re-elected and serve two consecutive five year terms but must sit out one election cycle before running for a third term. The Executive Committee will make appointments to the standing committees from the membership of the group.

Article IV: Graduate Group Chair

The Executive Committee will name a nominating committee of three members who will solicit the names of nominees for the group chair. The names of nominees indicating a willingness to serve will then be submitted to the group's faculty and students for comments. All comments will remain confidential. The Nominating Committee will forward two names to the Dean of Graduate Studies along with comments received on the nominees. The Committee may express a preference and should indicate the basis for the determination. After interviewing the nominees The Dean of Graduate Studies, in consultation with the group's lead Academic Dean, will submit the recommendation to the Chancellor for appointment. The normal term of appointment will be three years.

The Chair's responsibilities are:

- 1) Call and preside at meetings of the Executive Committee
- 2) Preside over graduate group meetings.
- 3) Appoint standing committees and their chairs in consultation with the Executive Committee
- 4) Act as the administrative liaison between the group and the Office of Graduate Studies.

Article V: Committees

1) Executive Committee

The Executive Committee shall determine and implement policy for the good of the Group and represent the interests of the Group to the University and other agencies.

2) Membership Committee

The Membership Committee shall consist of three members appointed by the Chair of the EC for terms of three years. The Membership Committee will be responsible for reviewing applications from faculty who wish to be part of the Group. In addition, the

Committee will review the membership of each member of the Group every four years. Members of the Membership Committee will excuse themselves while their own cases are being reviewed.

3) Educational Policy Committee

The Committee on Educational Policy shall consist of the chair of the Group, two graduate advisors, and two additional representatives. Membership on this committee is limited to regular UC Merced faculty. The EPC is responsible for establishing and guiding the educational programs of the Group. The EPC in consultation with the group faculty will determine changes in coursework, exam, and teaching requirements for students in the Group. The EPC will periodically conduct reviews of the program and will oversee the self-study associated with formal program reviews.

4) Admissions Committee

The admissions committee is charged with the development of recruiting materials for the Group, reviewing applications for admissions, and exploring graduate student support mechanisms.

Article VI: Student Representative

A non-voting student representative will be included on the educational policy committee when active. The group chair will choose the student representative after soliciting all active graduate students in the program for their interest. Students will serve a one-year term and can be reselected for a second term.

Article VII: Graduate Advisers

Graduate Advisers will be chosen from the Group faculty. These should be ideally senior faculty with a broad scope of understanding about the field although in a small group all faculty can serve in this role. These individuals will be responsible for dealing with coursework requirements, assisting students to identify major professors and establishing oral examination committees.

Article VIII: Meetings

The membership of the group should meet once during the fall and spring semesters. The Group chair is responsible for calling all regular and special meetings of the membership. Faculty can request additional meetings.

Article IX: Quorum

Issues that require a vote of the membership need to have a quorum of at least 50% of the total membership present. Voting may be done electronically so as to accommodate members who are off campus for extended period of time. A positive or negative decision requires a simple majority of the vote.

Article X: Order of Business

At all regular meetings the suggested order of business shall be as follows:

- 1) Reading of the minutes of the preceding meeting
- 2) Reports from the Chair of the Executive Committee
- 3) Reports from each of the Standing Committees
- 4) Old Business
- 5) New Business

Article XI: Amendments

Amendments to the By-Laws require approval by two-thirds of the voting members of the group. Written notice of the proposed amendment shall be sent to each member at least five working days prior to the meeting at which the amendment is to be discussed. All amendments must also be submitted to Graduate and Research Council for review and final approval.

APPENDIX F – SHORT-TERM STRATEGIC PLAN

Physics short term strategic plan, May 2013

Physics is the study of the natural world ranging from the very tiniest pieces of matter and energy, including molecules, atoms, photons, and subatomic particles, to the study of the entire universe. Breakthroughs in physics revolutionize technology and have a profound impact on our society. Imagine day-to-day life without liquid crystal displays, painless light emitting diode blood-oxygen monitors, laser eye surgery, satellites or the Mars rover.

Over the past seven years the Physics group has matured into a highly successful, cohesive and collaborative research program. Physics research at UC Merced spans three broad areas: Condensed Matter physics, Atomic, Molecular and Optical physics (AMO) and Biophysics. Our research programs have blossomed due to significant external research funding through NSF (including 5 prestigious NSF CAREER awards since 2008), NIH, DOE, AFOSR, DARPA, and NRL. Research collaborations between the Physics graduate group and Biological Engineering and Small-Scale Technologies (BEST), Chemistry, and Applied Mathematics graduate groups are common and have yielded numerous high impact publications.

The physics faculty (the graduate group and bylaw unit function as a single entity) currently consists of 10.5 FTEs with which we are able to consistently teach core physics courses with broader topics for undergraduates and graduate students offered only once every two years. We anticipate applying for CCGA approval for the physics graduate program in 2013. **Our program review last year identified 20 faculty FTEs as the approximate number needed to be a mature, although small, physics program.** At that point we could provide a critical mass for a successful research environment and be able to deliver an effective undergraduate and graduate physics curriculum. We aim to grow to this number within the next 5-8 years which requires a hiring rate of *two faculty per year*.

Our growth strategy is to enhance our strength in Condensed Matter, AMO and Biophysics while gradually broadening the scope of our program through complementary research emphases. Enhancing and maintaining gender equity is highly desirable in a modern physics department, a field traditionally highly underrepresented by women. We anticipate that the quality and gender diversity of our current group (a remarkable 48% female department compared to the national average of just 14% (American Physical Society survey, 2010)) will appeal to the best female physicists in any particular search cycle.

Metrics for program success in a physics graduate program or department include number of peer reviewed publications, particularly in high ranking international journals, a high level of grant funding from both federal and state agencies (including individual and center grants), graduate degrees awarded and placement of our students in academic and industrial leadership positions. We are currently collecting data in these areas and will continue to explore alternative metrics to assess the health and success of our program. – towards the goal of achieving national and international prominence.

FTE Requests: Two-year physics hiring priorities for 2013-2015

The primary goals of this hiring plan are to **enhance the current research strengths** of our major and graduate programs. We anticipate that any Physics graduate group FTEs would be hired through the Physics bylaw 55 unit and would teach graduate and undergraduate physics courses.

Search Year 2013-2014 (not in order of priority)

- Atomic, Molecular and Optical Experimentalist.
- Condensed Matter Experimentalist

Search Year 2014-2015 (not in order of priority)

- Soft Matter/Biophysics Experimentalist
- Atomic, Molecular and Optical Experimentalist.

Search Year 2013-2014

Atomic, Molecular and Optical (AMO) physics experimentalist

This open-rank position seeks an experimental physicist trained in atomic and molecular or optical physics. The areas of research of interest include ultrafast optical phenomena, attosecond studies, fundamental quantum processes and engineering, atomic cooling and trapping, precision measurement, novel imaging techniques, quantum information in quantum many body systems and semiconductor photonics. New programs as well as research in areas complimentary to existing UC Merced faculty are welcome.

Condensed Matter physics experimentalist

This open-rank position seeks applicants who are trained in experimental physics with research interests in condensed matter physics. Fields of interest include photonic materials, nanoscale electronics, quantum information and photovoltaics. We seek candidates whose research is complementary to the work of existing faculty in the School of Natural Sciences.

Search Year 2014-2015

Soft Matter/biophysics experimentalist

This open-rank position seeks applicants who are trained in experimental soft condensed matter physics or biophysics with research interests in liquid crystal physics, colloidal science, polymer physics, biomaterials and biopolymers, membranes and associated phenomena, single cell studies of biomechanics including motility and mitosis, microfluidics with biological applications and protein folding. We seek candidates whose research is complementary to the work of existing faculty in the School of Natural Sciences.

Atomic, Molecular and Optical (AMO) physics experimentalist

This open-rank position seeks an experimental physicist trained in atomic and molecular or optical physics. The areas of research of interest include ultrafast optical phenomena, attosecond studies, fundamental quantum processes and engineering, atomic cooling and trapping, precision measurement, novel imaging techniques, quantum many body systems and semiconductor photonics. New programs as well as research in areas complimentary to existing UC Merced faculty are welcome.

Summary of proposed projected growth for physics faculty hires for the next four years

<i>Search year</i>	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
FTEs already hired	10.5	11.5	13.5	15.5	17.5
Predicted searches	1	2	2	2	2
Total FTEs if search successful	11.5	13.5	15.5	17.5	19.5

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School of Natural Sciences
Office of the Dean

University of California, Merced
5200 North Lake Road
Merced, California 95343
(209) 228-4309 Fax: (209) 228-4060

August 16, 2013

TO: Valerie Leppert, Chair, Graduate and Research Council
FROM: Juan C. Meza, Dean, School of Natural Sciences
RE: Support for Physics Graduate Group Proposal

A handwritten signature in blue ink, reading "Juan C. Meza", is written over the "FROM:" line of the header.

I am pleased to offer my support for the proposed graduate program in Physics. The faculty members of the Physics group have established three emphasis areas for strategic planning: 1) atomic, molecular, and optical physics, 2) condensed matter physics, and 3) biophysics and soft matter physics. Each of the emphasis areas already has a small but strong core group of faculty. Together the three areas span a broad and exciting range of research topics that should attract many interested students.

Currently, there are ten research faculty members and one LPSOE in the Physics unit. I anticipate that the unit will grow by one new faculty member per year through 2016. It is impressive that out of the ten research faculty, four have received prestigious NSF CAREER awards. Equally impressive is the ratio of women to men, with five of the eleven faculty being women. At the beginning of academic years 2011–2012 and 2012–2013 graduate enrollments in Physics Graduate Studies were 19 and 28, respectively; the total enrollment for 2013 is predicted to be 34. These numbers are small by comparison to other physics programs but they have been steadily growing and I expect that they will continue to increase as we add new faculty. In addition, the current students have been quite productive with 25 papers co-authored with faculty over the last 4 years.

As the Dean of the School of Natural Sciences, I commit to continued administrative and financial support for the proposed Physics Graduate program. All Physics Graduate Studies students have been fully supported financially during the academic years, either by a Teaching Assistantship (TA), a Graduate Student Assistantship (GSA), or a full-time fellowship. It is expected that the need for TAs will continue as the undergraduate programs at UC Merced continue to grow. Therefore, we anticipate that there will be sufficient TAs available to current and future Physics students.

As the Physics graduate program continues to grow, a larger fraction of the students should be supported by GSRs and fellowships to allow them more opportunities to concentrate on their research. One avenue for this path is based on a new funding mechanism that became available last year. Beginning with AY 2012–2013, USAP funds have become available for supporting graduate student research fellowships. It is my understanding that the Physics graduate group has been allocated approximately \$81,000 of USAP fellowship funds for AY 2013-2014, which will help support both academic year and summer fellowships.

In addition to financial support for graduate students, I will continue to provide a portion of the time of four staff members in the School of Natural Sciences office to assist in all aspects of graduate student support.

The major constraint in accommodating the Physics program growth will be space for experimental labs. The school is currently reaching a limit on the number of labs available for experimentalists. With the anticipated opening of SE2 in the fall of 2014, some additional lab space will open up allowing the School of Natural Sciences to hire more experimentalists. However, I anticipate that we may reach full capacity again as early as 2-3 years after SE2 opens up.

I also do not anticipate any major resource impacts on other academic programs as a result of this proposal. The physics graduate program has already been supported jointly with the Chemistry and Chemical Biology (CCB) and there are excellent collaborations with the Applied Mathematics group. One area that should be addressed however, is the need for shared computational resources. Both the Applied Mathematics and the CCB groups have several faculty that require or will soon require access to larger computing facilities. I encourage all three graduate groups to have a discussion on how to proceed so that the existing computing facilities are used as efficiently as possible and so that the groups can plan for future growth.

In summary, I am pleased to support the proposed Physics graduate program proposal. The program will foster the intellectual growth of individuals who will develop the experimental, theoretical and computational skills necessary to advance our fundamental understanding of the world and who can apply their knowledge to solve society's challenging and important problems.



OFFICE OF THE ACADEMIC SENATE
SUSAN AMUSSEN, CHAIR
[samussen@ucmerced.edu](mailto:samusen@ucmerced.edu)

UNIVERSITY OF CALIFORNIA, MERCED
5200 NORTH LAKE ROAD
MERCED, CA 95343
(209) 228-7954; fax (209) 228-7955

June 8, 2012

EVC/PROVOST KEITH ALLEY

RE: COURSE BUYOUT POLICY

Thank you for soliciting DivCo's comments on the draft policy for course buyouts. We assume this was at least in part a response to the proposal made by the SSHA faculty, which built on a GRC memo based on extensive research into the practices of other UC campuses on this topic. DivCo was pleased to see that a draft policy exists, but we have questions about its operation both from the perspective of faculty who seek to buy out a course, and from the perspective of undergraduate and graduate program leads.

From the faculty perspective, the policy appears to discourage, rather than encourage, faculty to obtain grants that buy out their teaching, at least compared to other UC campuses. We do not think this is wise for a fledgling campus trying to encourage extramural funding.

1. Price of the buyout: According to the research undertaken by the faculty, 17% is the highest amount charged in the UC system. For example, Riverside asks only for 10% of salary for a one course buyout, and 25% for two courses.
2. What happens to the money? At other campuses, the money is either given to the Department/Academic Unit, or split between the Department and the Dean. Unlike every other UC campus, the proposed policy gives all the money to the Deans, and none of the money to the unit. The policy should specify that some portion of the funds obtained through a course buyout should be used for teaching needs in the academic program, and that some portion be given to the academic unit as is done at all other UC campuses. On many campuses, those units can also use some portion of the funds to augment the faculty member's research funds. Some such flexibility gives faculty more incentive to include such funds in their grant proposals.
3. While we understand the general restriction to buying out no more than one course a year, the policy needs to contain an explicit proviso which allows flexibility when faculty members receive awards with particular requirements: for instance, Spencer Foundation grants, or NIH Career awards, would require a complete release from most

or all teaching obligations. This might be phrased as “Exceptions to this policy can be made, in consultation with the Dean and Program leads, for awards (such as NIH Career Awards) that require more release time than this.”

4. The policy provides no incentive to request AY funds in a grant proposal without taking a teaching reduction. On some campuses, at least some portion of such funds would come back to the faculty’s research funds as an incentive to bring more extramural funding to the university. The exclusion of this possibility is short-sighted, as both the campus and the faculty member can benefit from additional extramural funds.

From the Program perspective, we need to be sure that the deans consult not just with “chairs” (which usually means, in our context, Academic Unit chairs) but also the leads of graduate and undergraduate programs with which a person is affiliated.

1. If a faculty member is teaching a required course, or an elective course that impacts students' progress towards degree, there needs to be a provision ensuring that either the course is being taught by someone else, or that it is not necessary that semester, such that there is no negative impact on students.
2. Teaching requirements: The teaching requirements specified in the policy seem more appropriate to SSHA than to the other Schools, where faculty who have bought out one course will only teach one course that AY. In that case, it makes sense for the Dean and relevant program leads (graduate and undergraduate) to determine where a faculty member’s teaching is most important. The provision that the faculty member must teach an undergraduate course fails to recognize that a graduate program may be adversely impacted by a faculty not teaching a course, and graduate courses may be more difficult to cover than undergraduate ones. Particularly given our small size, it is possible that it will be more important that a faculty member teach a graduate course than an undergraduate one. This is an area where flexibility will be important.
3. The policy should note that particular Schools or academic units may have more restrictive policies than those specified in the campus policy.

Sincerely,



Susan Amussen
Chair

cc: Divisional Council
Senate Executive Director Susan Sims



Office of the Executive Vice Chancellor and Provost

UNIVERSITY OF CALIFORNIA, MERCED
POST OFFICE BOX 2039
MERCED, CALIFORNIA 95344
(209) 228-4439
FAX: (209) 228-4423

MEMORANDUM

To: Susan Amussen, Chair, Divisional Council

From: Keith Alley, EVC/Provost 

Subj.: UC Merced Course Buyout Policy

Date: May 25, 2012

Attached is a draft Course Buyout Policy that has recently been developed in conjunction with the Deans of all three Schools. We request that the Divisional Council review this policy and provide feedback to the EVC regarding the policy and any concerns regarding its implementation.

Thank you.

Cc: David Ojcus, VPAP
Nancy Ochsner, AVP
Mark Aldenderfer, SSHA
Juan Meza, SNS
Dan Hirleman, SOE
Susan Sims, Exec Director

Course Buyout Policy: External Buyouts from Extramural Funding	
	UC Merced Campuswide
Who is eligible?	Senate faculty with extramural grant-funding
Purpose	Allows faculty members to expand time available for research and other scholarly work
Maximum # courses	1 annually. Also restricted to no more than 3 courses over a 5 year period. Particular Schools or academic units may have more restrictive policies.
Cost	1/6th of 9-month salary + benefits per course (3-4-unit courses only)
Policy: In Residence & Service requirements	Buyout participants expected to remain in residence for the duration of the course buyout and must continue to be fully engaged in normal range of service commitments to department, campus, and profession.
Policy: Funding	Faculty member must have extramural funding to pay for external buyouts; Buyout funding reduction must occur in actual semester of buyout.
Policy: Sabbatical leave	Program may not be used in conjunction with sabbatical leave. Sabbatical leave credit continues to accrue.
Policy: Teaching requirements	In the buyout year, faculty member must teach at least one undergraduate course that significantly contributes to the major (e.g., required course), or general education and/or represents significant service (e.g., large survey courses).
Approval	Requires Chair's, Dean's, and EVC's approval
Exceptions	By request and must be justified and then approved by Chair, Dean, and EVC. The Deans and Chairs will also consult with the Program leads.
Use of salary savings from external course buyouts	100% of state-funded salary dollars released by the course buyout is retained by the School. The first call on the released funds will be replacement of unmet teaching needs.
Reporting	Deans must report annually to EVC on amount of dollars released and how the funds were used.

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OFFICE OF THE PROVOST AND EXECUTIVE VICE CHANCELLOR

UNIVERSITY OF CALIFORNIA, MERCED
5200 N. LAKE ROAD
MERCED, CA 95343
(209) 228-4439

Date: August 8, 2013

To: Peggy O'Day, Chair, Academic Senate

From: Provost Thomas W. Peterson

A handwritten signature in cursive script, reading "Thomas W. Peterson".

RE: Proposed revisions to SACAP Charge

Please find attached for the Senate's consideration and input a proposed revised charge to the Senate Administration Council on Assessment and Planning.

As you will see, the charge has been revised to

- Include a focus on establishing a sustainable, campus-wide system of assessment practices together with consideration of necessary resourcing.
- Clarify its role as an advisory council to the Provost/EVC and Senate.
- Clarify the council's contributions including outputs.

Also proposed is a role in advising the Budget Committee on assessment support-related budget proposals.

Changes to the membership are also suggested. These include the addition of the Budget Director on the administrative side. On the Senate side, it is suggested that the Chair of the Program Review Committee join the council as a co-chair to support a focus on integrating annual and periodic assessment processes. In keeping with last year's discussion, it is also suggested that the Council include a representative from each School's Executive Committee to better connect SACAP's work to school level processes and priorities. Connections to Divisional Council and the Senate's role in resource allocation would be maintained through the memberships of the Vice Chair of Divisional Council and CAPRA Chair (or designee).

Historically, annual turnover in SACAP membership has challenged the council's ability to advance its efforts year over year. The council would be expected to be more effective with longer terms of service. Toward this end, I ask the Senate to consider the possibility of two year appointments for a subset of senate representatives, including perhaps mostly importantly the Senate Co-Chair of this council.

Finally, the proposed membership includes one more administrative than faculty representative. The charge includes a proposed solution to any voting concerns this might raise in a final parenthetical item.

I thank the Senate for its ongoing commitment to this important coordinating and advisory council in support of the campus' efforts to sustainably integrate assessment into campus practices and processes. The work is not done, but I hope that the proposed revisions to the council's charge will advance its contributions substantially.

I am happy to discuss the revised charge with you, but hope we can finalize a charge as soon as possible, with the goal of SACAP meetings resuming by September of the new academic year.

Cc: Susan Sims, Chief of Staff, Special Assistant to the Provost
Laura Martin, Coordinator for Institutional Assessment