Florida Atlantic University
Academic Program Review
Department of Physics
Self-Study Report

Program:	Department of Physics
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A. Mission and Purpose of the Program

The mission of the Department of Physics at Florida Atlantic University is to foster a deeper and more holistic understanding of the fundamental interactions in nature, and apply this knowledge to both pure and applied aspects of the discipline.

We strive to provide first-rate undergraduate and graduate education in physics to our students and to increase scientific knowledge in the community at large.

We seek to advance the frontiers of scientific knowledge by engaging in innovative research and tackling fundamental problems in physics.

We work to bridge research, education, and applications of the physics to serve the needs of the local community and the larger global society.

B. Previous External Reviews and Executive Summary

The Department of Physics was last reviewed in 2009 by the Dean as an internal review. That review came at the end of a period of strong national economy and steady growth of FAU's budget, and its overall tone was positive and optimistic, but was concerned with the operating budget of the department (faculty positions, HPC infrastructure, and antiquated instructional laboratory equipment). It pointed out that the Department of Physics had made significant and quantifiable progress since the previous program review in 2001, especially in the growth in the quantity and quality of the graduate Ph. D. program applications, and the introduction of a new Certificate Program in Medical Physics. The review also noted proactive changes made in the curricula of the undergraduate degree programs, in which standards were raised and the breadth and depth of the material increased. The department opened an undergraduate student study room, introduced a constructive annual evaluation of each graduate student and strengthened our successful outreach programs in astronomy and physics. While T/TT faculty was flat during this time, instructional faculty increased. Nevertheless, research publications by physics faculty remained roughly constant at two refereed papers per T/TT faculty. Community outreach focused on our Astronomy Observatory, on the annual Physics Carnival and Pumpkin Drop, and with substantial participation in the Science Olympiad.

There were two Major Findings and Recommendations from the Dean's Internal 2009 program review:

- "Improvements to the programs could be made by upgrading the university's high power computing facilities and the educational and research environment, for instance by funding more post-doctorates in the department, who could also be mentors to graduate students."
- "We are barely able to keep up with the natural attrition in the faculty ranks in the department, and given the financial sanctions on the state's higher educational system and in particular FAU, we will find it difficult to maintain our expansion rate in education and research in physics."

Unfortunately, that program review came at the start of a sharp downturn in the national economy and a series of yearly budget cuts to the university. An attempt was made by the university to grow out of the budget shortfall by steadily increasing enrollments, even as the Department of Physics lost 25% of their T/TT faculty lines and was reduced to 9 T/TT faculty. The physics department struggled to maintain the innovations and progress noted in the 2009 program review and found it difficult to secure resources to implement the recommendations from that review. Nevertheless, some progress has been made.

- We built and obtained provisional accreditation for our Professional Masters in Science in Medical Physics. We also hired a Visiting Assistant Professor in Medical Physics and have the approval to replace this Visiting Professor with a permanent line.
- Using funds from four internal FAU Technology Fee grants, the department outfitted the astronomy dome, purchased a GP-GPU computer for HPC training and research, outfitted the Medical Physics Laboratory and Updated computers for the UG Laboratory.
- The department also hires undergraduate students as tutors and graders for our introductory courses.
- Graduate stipends have not increased since the last program review, and the number of PhD stipends available for physics graduate students decreased from 34 to 28. Perhaps the most disruptive effect from the budget cuts was directive not to admit any Ph. D. students in 2012.
- This past year, the department hired one Assistant Professor in the area of Loop Quantum Gravity (to appear Fall 2015).
- We have substantially increased our UG enrollment in Physics. We established the Owl's Burrow (research and study room for UG physics majors); however, most importantly we have appointed two staff members to work closely with our UG's in order to provide a more stimulating educational and interactive environment.
- Jon Engle and Warner Miller each hired a postdoctoral fellow under their federal grants. One started in September 2014; the other starts in 2015.

- With the completion of the Engineering East building a few years ago, the physics department inherited some space on the 3rd floor in the SE building vacated by the College of Engineering, but lost much space on the 4th floor to the Geoscience Department. Much of this space was used to construct seminar/colloquia/tutoring space, space for the new Medical Physics program; the rest went to graduate student offices. Office space and tutoring space remains a serious concern.

- We are in the process of recruiting a Bio-photonics group here to FAU in collaboration between CESCOS and the College of Engineering and Computer Science. This initiative would support the strategic plan of the university as well as bring a needed experimental component to our department. We have had to send to of our PhD students out of state for their dissertation research due to the lack of experimental opportunities in physics. We view this as our top priority.

C. Instruction

1. Undergraduate Programs and Courses

The Department of Physics offers undergraduate programs leading to the Bachelor of Arts (B.A.) and Bachelor of Science (B.S.) degrees. An Honors Program and a minor in Physics are also available.

Another program, leading to a specialized Bachelor of Arts in Education (B.A.E.) and State of Florida certification for prospective secondary physics teachers, is also partially described here. However, this degree is offered through the Department of Teaching and Learning in the College of Education. The discussion here is limited to its required physics and mathematics components.

Establishment of Goals

The department will continuously review its undergraduate programs in order to create an environment in which students succeed. In addition, we will attempt to enrich the students' educational experience by monitoring three learning outcomes: content knowledge, communication skills, and critical thinking (see Appendix 1).

Assessment of Student Learning Outcomes

Assessment of SLOs in the BS/BA programs is performed using three Outcomes:

1. Graduates in Physics will understand basic concepts, theories, and experimental findings in four core areas of physics (particle and wave mechanics, electricity and magnetism, thermodynamics and modern physics). As the course in Modern Physics (PHY 3101) contains all core areas, a combination of class presentations, target assignments and exams during the semester that cover different target areas in this course is used for assessment of declarative knowledge. The instructor of PHY 3101 evaluates the students as to their knowledge of basic concepts, theories and experimental findings in the four core areas.

2. Graduates in Physics will be able to produce writing that is grammatically correct, well-organized, properly formatted and demonstrates understanding of scientific methodology. Reports are written in the laboratory courses Undergraduate Laboratory (PHY 4811L) and Physical Electronics (PHY 3722C), which constitute a substantial portion of the course requirements. The Chair and/or designee evaluates reports written for PHY 4811L and PHY 3722C and grades them on a scale of 0-4 to assess whether students have appropriate writing skills and a clear understanding of the scientific method in general and how it applies to physics.

3. Graduates in Physics will have first contact with current science and the scientific community by participating in undergraduate research, and in appropriate academic and social activities. The Chair or designee will encourage and motivate students by meeting with them on a regular basis to encourage participation in scholarly activities of the Society of Physics Students (SPS a.k.a. physics club) and departmental seminars

Program Improvement

The Physics Department is currently in the process of making substantial changes to the undergraduate curriculum. One of the main additions to the new curriculum is an upper-division Advanced Undergraduate Seminar course (1 credit per semester), offered each semester with varying topics. There will be 4 credits required from that course for graduation, i.e. it has to be taken over 4 semesters. A syllabus for this course that includes research presentations by faculty and students, scientific computing using Matlab and/or Mathematica, scientific writing and typesetting using Latex, writing applications and research proposals etc. has been forwarded to the Undergraduate Program committee.

This course, as soon as it offered, will replace the laboratory courses PHY 4811L and PHY 3722C currently used for the assessment of writing, presentation and communication skills, and understanding of scientific methodology by our students. Several revisions in the curriculum are intended to get in particular upper-division undergraduates to participate more in ongoing research in the department, i.e. to allow more flexibility in the course selection, so they can take more specialized (with permission even graduate) courses that fit in their area of interest. It is expected that such a specialization will boost motivation to participate more in ongoing research at the department.

We also expect that the Advanced Undergraduate Seminar course will lead to a closer community among the students as most of them will be in the same classroom at least once a week for an extended period of time (4 semesters). In addition to improving the UG curriculum we have concentrated on improvements to our UG instructional laboratories, both at the lower level and upper levels.

Improvements to Upper Level (Upgrading the Physics UG Laboratory, PHY 4811L)

1. Dr. Qiu (professor of physics) received an Award of $40,000 from FAU Technology Fee Committee on May 25 2014 for upgrading experimental modern physics lab.
2. Achievements
   (a) Six brand new modern physics experiments have been setup.
   (b) Seven experiments have been computerized.
   (c) Ten new lab manuals have been written.
   (d) State-of-the-art computer-interfaced data acquisition technologies including PASCO 850 interface, Capstone software, computer-interfaced sensors, Dell OptiPlex 9020 computers have been used in all the computerized experiments for PHY4811L.
3. Plan in 2015
   (a) Six new experiment apparatus will be setup.
   (b) Six new lab manuals will be written.
   (c) Establish a joining directed-independent-study (DIS) project with Dr. Miller for undergraduate student to setup cosmic ray detection experiment in modern physics lab.
   (d) Updated modern physics lab provides graduate students in Medical physics program with advanced experiment apparatus such as NMR (nuclear magnetic resonance) which leads to MRI (magnetic resonance image), a noninvasive imaging technique that discriminates among various body tissues on basis of the different environments of protons in the tissues.
4. Community outreach
   Demonstrations of NMR, speed of light, hydrogen line spectra (using gratings), blackbody radiation spectra (using prism dispersion), polarization of light (using polarizer), etc., will be shown during FAU Science Summer Camp 2015.
5. Collaboration with Chemistry department
   We collaborated with Tanya Kelley (graduate student in Chemistry) to measure the emission spectra of various LED in 2014.

Tanya Kelley made some absorption samples for our absorption experiments.

6. Goals of upgrading experimental modern physics lab
   (a) Updating modern physics lab will boost FAU's IT infrastructure by providing equipment to train students in the use of latest technology and software, and make physics education program for undergraduates of science at FAU comparable to any university in Florida. Moreover, the latest computer-interfaced and sensor-based data acquisition technologies have also extensive applications in Chemistry, Biology, Environmental science and Engineering. The experience gained from the updated modern physics lab will equip the undergraduates of science to work in any of related areas.
   (b) Provide undergraduates of science with state-of-the-art computer-interfaced data acquisition technologies to enhance their hand-on experience and ability of performing various new complex experiments, which are indispensable under today's research climate and play a role of bridge between classroom study and research works, therefore, it is an important implementation of the Quality Enhancement Plan (QEP).
   (c) Make modern physics lab more attractive and exciting to encourage and guide undergraduates of science learn the cutting-edge science and join scientific research work, which will certainly attract more students to study science at FAU, improve the retention and graduation rates of students.

Upgrade of modern physics lab will enhance students' experiences for handling difficult problems using latest technologies such as how to organize investigations for various experiments, collect, record and analyze data; draw conclusions and present experimental results using vivid graph, video and written forms. These experiences are within complete alignment with the statewide effort in producing graduates meeting the workforce needs.

Renovation and Improvements to Lower Level General Physics Labs (PHY 2048L, PHY 2049L)

- Dr. Chen (faculty member and lab coordinator of physics) received an Award of $118,000 from FAU Technology Fee Committee on May 2, 2013 for renovation and expansion of general physics labs.
- State-of-the-art computer-interfaced data acquisition technologies including PASCO 850 interface, Capstone software, computer-interfaced sensors, Dell OptiPlex 9020 computers will be used in all the computerized experiments for both PHY2048L and PHY2049L starting from spring 2015.
- Two textbooks will be published by Kendall Hunt Publishing Company in spring 2015.
  (a) De Haui Chen and Shen Li Qiu, "PHY2048L General Physics 1 Lab Manual" (4th edition).
  (b) De Haui Chen and Shen Li Qiu, "PHY2049L General Physics 2 Lab Manual" (4th edition).
- Enrollments of PHY2048L and PHY2049L in recent 6 years

Enrollments	2006	2007	2008	2009	2010	2011	2012	2013	2014
PHY2048L	517	617	599	769	927	920	1050	1066	1044
PHY2049L	421	512	522	575	711	812	773	898	881
Total	938	1129	1121	1344	1638	1732	1823	1964	1925

- TA training program

  Our department has established and developed TA training program for PHY2048L and PHY2049L labs. Dr. Chen spends several hours per week for training lab TAs before they teach their lab sections. TAs are confident in teaching their lab sections when they are equipped with first-hand experiences and with their own data.

  Our TA training program has the following advantage over the video teaching method used by many

universities including FIU (as a peer institute):
(a) Students can get immediate and efficient help from TAs rather than watch video.
(b) Ensure high teaching quality and keep the same standard for all (~ 60) lab sections.
(c) Enhance TAs teaching experience and skills of tackling complex problems.

- Community outreach
  (a) Dr. Chen and Dr. Qiu participated in FAU Science Summer Camp 2014 by demonstrating many exciting physics experiments.
  (b) Dr. Chen was supervisor for Florida Science Olympiad Circuit Lab (C) on 2/15/2014 using our lab rooms and equipment.
  (c) Dr. Qiu was supervisor for Florida Science Olympiad Shock Value (B) on 2/15/2014 using our lab rooms and equipment.
- Goals of renovation and expansion of general physics labs.
  (a) **S**tate-of-the-art computer data acquisition and data analysis software along with modern experimental instrument provide first-rate undergraduate education in physics to students at FAU, comparable to any university in Florida.
  (b) Renovation and expansion of general physics labs will allow students to register in lab sections at their favor hours and get timely help from their lab instructors, therefore, attract more students to study science at FAU, to improve the retention and graduation rates of students.
  (c) Renovation and expansion of general physics labs will enhance students' "hands-on" experiences including how a problem in experimental physics is tackled, how to organize the investigation, collect and record data, analyze the data, draw conclusions, how to present experimental results using vivid graph and written forms. These experiences are within complete alignment with the statewide effort in producing graduates meeting the workforce needs.

Our UG Program Coordinating Committee strives to integrate the UG experience in the department with scientific activities in the Department, College, University and Community. We have recently implemented an UG seminar series in the new UG Owl's Burrow. This room is dedicated to our UG physics majors, and gives them a place to interact with each other, study, keep records. Talks are given biweekly by graduate students, faculty and visitors in this room. We hold frequent (at least biannually) meetings with the UG physics majors and exchange ideas for program improvement. We do not know what role this has had in our 40% increase in total UG physics majors.

State-Approved Prerequisites

Our Core Curriculum and General Education courses have been thoroughly reviewed by FAU's Core Curriculum Committee for compliance with FL SUS requirements (6.017). The University Undergraduate Programs Committee has recommended their approval to the senate, and we fully expect that all courses will be approved at the next senate meeting, thus keeping all of our courses in compliance with these regulations.

Limited Access

The BA and BS programs in physics are not limited access programs; they are open to all students admitted to FAU.

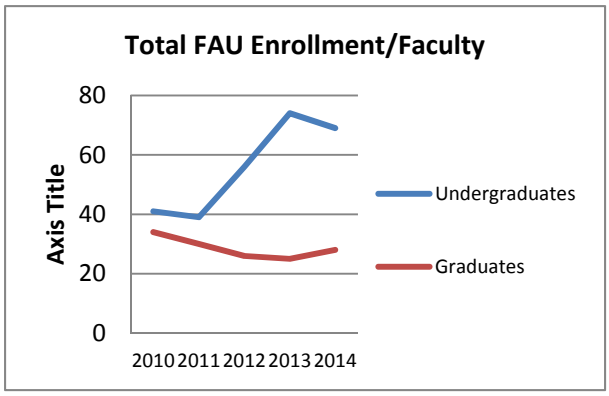
Admission Criteria

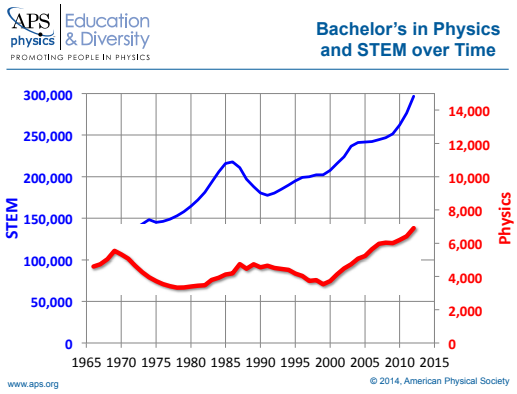
There are no admissions requirements for the BA or BS degree programs in physics. If an entering freshman lists physics as a major, then they are admitted to our degree program. If a student wishes to change major, then the student must have at least a 2.00 GPA.

Enrollment Information

The following table (from IEA) and plot gives headcount of undergraduate and graduate majors in physics.

Enrollment	**2010**	**2011**	**2012**	**2013**	**2014**
Undergraduate	41	39	56	74	69
Graduate	34	30	26	25	28





FAU's increase is consistent with US averages.

The following tables (from the DDI) gives state-fundable FTE at the undergraduate level, first the total, and then breakdown between lower-division and upper-division, and between majors within the department or college and outside of the college.

Annualized State-Fundable FTE Per Faculty	Physics			College Total	University Total
	2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Undergraduate Total	322.5	330.5	355.2	3,948.6	15,335.0

*Chart C1: Annualized State-Fundable FTE Produced By Level -- under Productivity Data in DDI

Annualized Undergraduate State-Fundable FTE Produced In/Out of	Physics	College of Science	University Total

Department/College		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Course Level	FTE produced by students who are:					
Lower Division	Majors within the department	3.3	2	5.1	202.4	729.1
	Majors outside the department, but within the college	147.5	144.9	168.6	839.9	1,743.9
	Majors outside the college	166.4	176.4	173	1,606.2	4,111.2
	Total	317.2	323.2	346.6	2,648.5	6,584.2
Upper Division	FTE produced by students who are:					
	Majors within the department	4.4	5.3	6.6	785.7	5,103.4
	Majors outside the department, but within the college	.5	.7	.2	268.5	2,343.8
	Majors outside the college	.5	1.3	1.9	246.0	1,303.6
	Total	5.3	7.3	8.6	1,300.2	8,750.8

*Chart C2: Annualized State-Fundable FTE Produced In/Out Of Department or College -- under Productivity Data in DDI

One sees the striking imbalance between lower-division versus upper-division FTE (by a factor of more than 40) and between FTE produced by non-physics majors versus physics majors (by a factor of more than 37). This imbalance is not viewed as an issue as traditionally only one tenth of one percent of the entering class in a university chooses physics as a major. It nevertheless, demonstrates the service component of our teaching for the university.

Average Class Size and Faculty/Student Ratio

The following table (from IEA) summarizes average class sizes in undergraduate physics classes, compared with college and university averages, and also notes the number and percent which were faculty taught.

Undergraduate Classes		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Type						
Lecture/ Seminar	# Sections	44	41	47	692	5,154
	# Enrolled	3249	3355	3535	47,552	192,004
	Avg Section Enrollment	73.8	81.8	75.2	68.7	37.3

Undergraduate Classes		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
	# Faculty Taught	34	34	38	475	3,487
	% Faculty Taught	77.3	82.9	80.9	68.6	67.7
Lab	# Sections	124	124	123	633	931
	# Enrolled	1696	1699	1931	12,456	18,859
	Avg Section Enrollment	13.7	13.7	15.6	19.7	20.3
	# Faculty Taught	124	124	123	345	502
	% Faculty Taught	100	100	99.2	54.5	53.9
Discussion	# Sections	N/A	N/A	N/A	125	258
	# Enrolled	N/A	N/A	N/A	3,989	7,208
	Avg Section Enrollment	N/A	N/A	N/A	31.9	27.9
	# Faculty Taught	N/A	N/A	N/A	78	211
	% Faculty Taught	N/A	N/A	N/A	62.4	81.8
Other Course Types	# Sections	2	N/A	3	322	1,380
	# Enrolled	3	N/A	6	974	8,897
	Avg Section Enrollment	1.5	N/A	2	3.0	6.4
	# Faculty Taught	2	N/A	3	304	1,073
	% Faculty Taught	100.0	N/A	100.0	94.4	77.8

*Chart B3: Average Course Section Size and Percent of Sections Taught By Faculty -- under Instruction Data DDI

In addition, for the 2012-2013 academic year, there were 74 undergraduate physics majors and 16 faculty members, for a student-to-faculty ratio of approximately 4.6 to 1.

The low student-to-faculty ratio reflects the small number of undergraduate physics majors compared with the size of the faculty. As noted earlier, non-physics majors produce a large proportion of the undergraduate FTE in the physics department. The average class size for lectures and seminar classes in physics compares favorably with the college and university (somewhat less than the college average but greater than the university average). All of the seminar, lecture classes and upper-division lab classes in physics are faculty-taught; however, the lower-level laboratory classes are taught by TA's with each supervised and trained closely by a faculty member as part of their professional academic training.

Undergraduate Physics Curriculum

Undergraduate Physics Core

All students seeking a major or minor degree in physics are required to complete the same introductory physics and mathematics sequences as well as an introductory natural science sequence outside the Department. Currently, students may opt for introductory sequences in either biology or chemistry, but the undergraduate advising committee may approve alternative sequences, even retroactively, on a case-by-case basis.

Introductory Physics Courses		
General Physics 1	PHY 2048	4
General Physics 1 Lab	PHY 2048L	1
General Physics 2	PHY 2049	4
General Physics 2 Lab	PHY 2049L	1
General Physics 3	PHZ 2106	4
Total		**14**

Introductory Mathematics Courses for Physics Majors		
Calculus with Analytic Geometry 1	MAC 2311	4 **or**
Calculus for Engineers 1	MAC 2281	4
Calculus with Analytic Geometry 2	MAC 2312	4 **or**
Calculus for Engineers 2	MAC 2282	4
Calculus with Analytic Geometry 3	MAC 2313	4
Total		**12**

Courses in Related Sciences, either		
General Chemistry 1	CHM 2045	3
General Chemistry 1 Lab	CHM 2045L	1
General Chemistry 2	CHM 2046	3
General Chemistry 2 Lab	CHM 2046L	1
or		
Biological Principles	BSC 1010	3
Biological Principles Lab	BSC 1010L	1
Biodiversity	BSC 1011	3
Biodiversity Lab	BSC 1011L	1
Total		**8**

To meet University degree requirements, students in any physics program must also complete 32 additional lower-division general education credits in courses outside the Charles E. Schmidt College of Science.

Bachelor of Arts with Major in Physics
(Minimum of 120 credits required)

The Bachelor of Arts (B.A.) degree program is offered for students seeking exposure to analytical methods in contemporary physics within a broader, liberal arts-style curriculum. Course requirements are significantly reduced compared with the Department's flagship B.S. program described later in this section. The Department does not recommend its B.A. degree for students planning graduate or professional work in physics. However, this program may be well suited to students planning work in related fields. Potential candidates should consult with the undergraduate advising committee to ensure this program will help meet their personal educational objectives before enrolling.

Prerequisite Coursework for Transfer Students
Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the *Transfer Student Manual*.

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

In addition to the Undergraduate Physics Core described above, B.A. candidates must complete the following required courses:

Additional Introductory Mathematics Course		
Matrix Theory	MAS 2103	3
Total		**3**

Intermediate Physics Courses		
Survey of Modern Physics	PHY 3101C	4
Classical Mechanics	PHY 3221	4
Electromagnetism 1	PHY 3323	4
Quantum Mechanics 1	PHY 4604	4
Choose at least one course from the following list:		
Thermodynamics	PHY 3503	4
Statistical Mechanics	PHY 4523	3
Physical Electronics	PHY 3722C	4

Total	**20**

Overall, this degree program requires 37 credits of lower-division mathematics and science courses and 20 credits of upper-division physics courses. Substitutions for required courses are allowed with prior approval from the Department's undergraduate advising committee.

Bachelor of Arts in Education with Major in Physics Education
(Minimum of 120 credits required)

The Bachelor of Arts in Education (B.A.E.) degree program is offered through the Department of Teaching and Learning in the College of Education. It is intended for students interested in teaching physics professionally at the secondary level. Students in this program will be advised through the Department of Teaching and Learning. However, content-course requirements are listed here for students interested in this program.

Prerequisite Coursework for Transfer Students
Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the *Transfer Student Manual*.

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

In addition to the Undergraduate Physics Core courses described above, B.A.E. candidates must complete the following required courses:

Intermediate Physics Courses		
Survey of Modern Physics	PHY 3101C	4
Electromagnetism 1	PHY 3323	4
Physical Electronics	PHY 3722C	4
Choose at least 8 credits from the following list:		
Classical Mechanics	PHY 3221	4
Thermodynamics	PHY 3503	4
Quantum Mechanics 1	PHY 4604	4
Total		**20**

Overall, this degree program requires 73 lower-division credits, including general education requirements for the B.A.E. degree, as well as math, science and education courses. It also requires 20 credits of upper-division physics courses and 24 credits of upper-division education courses. See the Department of Teaching and Learning in the College of Education for details.

Bachelor of Science with Major in Physics
(Minimum of 120 credits required)

The Bachelor of Science (B.S.) degree program is the flagship of the Department's undergraduate curriculum. It is designed to help students prepare for careers in physics, related sciences or closely related fields such as engineering. The emphasis is on analytical methods in contemporary theoretical and experimental physics. Students considering graduate work in physics or related areas are strongly encouraged to complete this program.

Prerequisite Coursework for Transfer Students
Students transferring to Florida Atlantic University must complete both lower-division requirements (including the requirements of the Intellectual Foundations Program) and requirements for the college and major. Lower-division requirements may be completed through the A.A. degree from any Florida public college, university or community college or through equivalent coursework at another regionally accredited institution. Before transferring and to ensure timely progress toward the baccalaureate degree, students must also complete the prerequisite courses for their major as outlined in the *Transfer Student Manual*.

All courses not approved by the Florida Statewide Course Numbering System that will be used to satisfy requirements will be evaluated individually on the basis of content and will require a catalog course description and a copy of the syllabus for assessment.

In addition to the undergraduate physics core described above, B.S. candidates must complete the following required courses:

Additional Introductory Mathematics Course		
Matrix Theory	MAS 2103	3
Total		**3**

Intermediate Physics Courses		
Survey of Modern Physics	PHY 3101C	4
Classical Mechanics	PHY 3221	4
Electromagnetism 1	PHY 3323	4
Electromagnetism 2	PHY 4324	3
Thermodynamics	PHY 3503	4
Statistical Mechanics	PHY 4523	3
Quantum Mechanics 1	PHY 4604	4
Quantum Mechanics 2	PHY 4605	3
Physical Electronics	PHY 3722C	4
Undergraduate Laboratory	PHY 4811L	2
Mathematical Methods for Physics	PHZ 3113	3

Total	**38**

Overall, this degree program requires 37 credits of lower-division mathematics and science courses and 38 credits of upper-division physics courses. Substitutions for required courses are allowed with prior approval from the Department's undergraduate advising committee.

Honors Program in Physics
Qualified physics majors may elect to complete an Honors Program (thesis) prior to graduation. The thesis will describe participation in current research under the supervision of a member of the Department faculty. A student completing a satisfactory thesis will receive the distinction "honors in physics" upon graduation.

To qualify for the program, students must maintain a GPA of at least 3.0 in required courses within the College of Science and complete a minimum of 30 credits of physics courses by the end of their junior year. Candidates should apply for this program through the undergraduate advising committee roughly one year prior to graduation.

Physics Minor

The Department offers a minor in Physics to interested students seeking bachelor's degrees in other fields. It is expected that most students interested in this program will major in fields sufficiently closely related that most of the undergraduate physics core will also fulfill major requirements. Students interested in this program should consult with the Department's undergraduate advising committee prior to enrolling.

In addition to the undergraduate physics core described above, candidates for a minor in Physics must complete the following required courses:

Intermediate Physics Courses		
Survey of Modern Physics	PHY 3101C	4
Choose at least one course from the following list:		
Classical Mechanics	PHY 3221	4
Electromagnetism 1	PHY 3323	4
Thermodynamics	PHY 3503	4
Physical Electronics	PHY 3722C	4
Quantum Mechanics 1	PHY 4604	4
Total		**8**

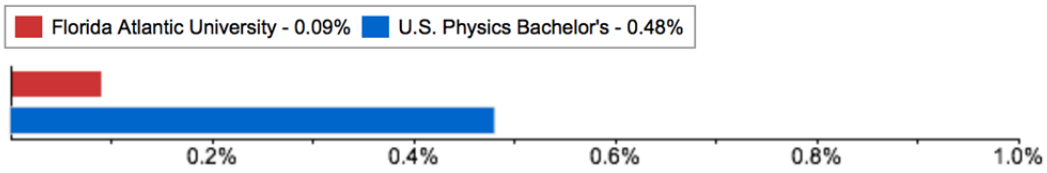
Overall, this degree program requires 26 lower-division credits in physics and mathematics and 8 credits of upper-division physics. Some of the lower-division credits may also satisfy candidates' major requirements. At least 75 percent of all credits required for the minor must be earned from FAU.

APS Comparison of US Undergraduate Physics Programs

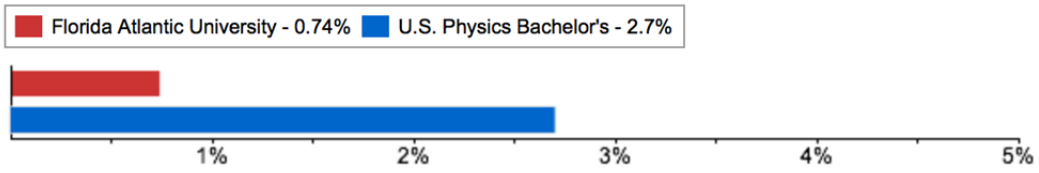
Data from American Physical Society’s Statistics
http://www.aps.org/programs/education/statistics/compare.cfm

Bachelor's Degree Data

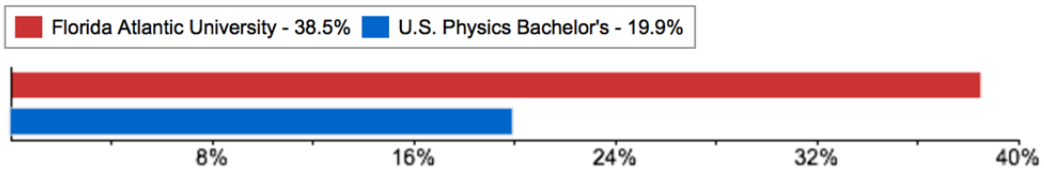
What percentage of all bachelor's degrees granted is physics degrees?



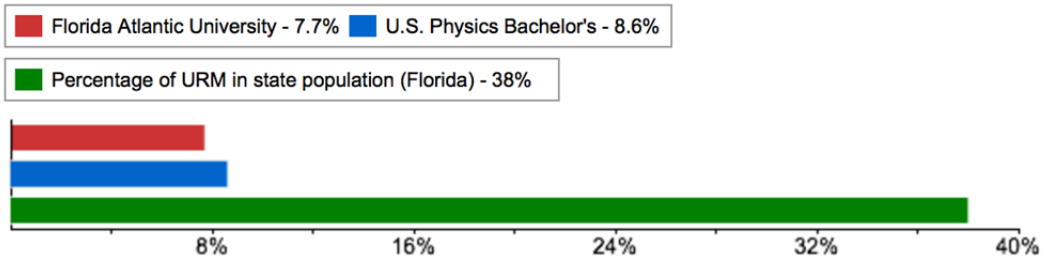
What percentage of STEM bachelor's degrees granted is physics degrees?

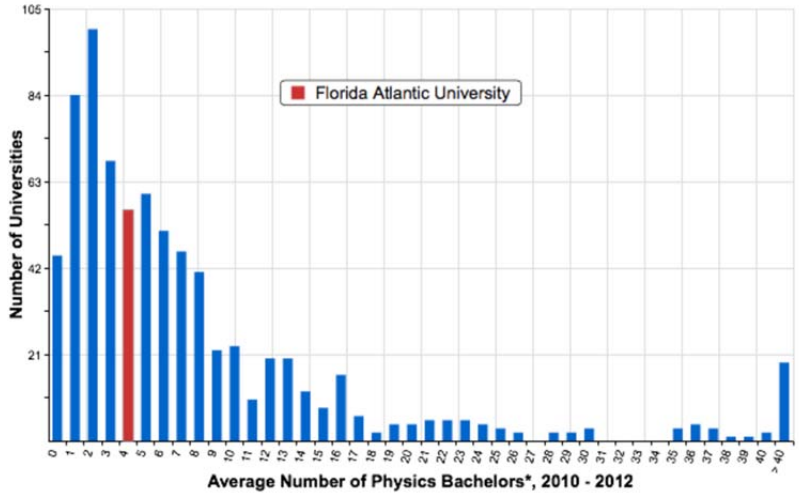


What percentage of physics bachelor's degrees is granted to women?



What percentage of physics bachelor's degrees awarded to U.S. citizens and permanent residents is granted to underrepresented minorities (URM)?†





Raw Data Used to Generate Statistics:

	Bachelor Degrees			Master Degrees			Doctorate Degrees		
Year	2010	2011	2012	2010	2011	2012	2010	2011	2012
Physics Degrees - All	3	7	3	1	8	7	3	-	6
Physics Degrees - U.S. Citizens & Permanent Residents	3	7	3	-	2	-	1	-	2
Total Degrees Awarded by Institution	4876	4958	5245	1184	1349	1259	88	74	117
STEM Degrees	511	603	633	144	164	162	36	22	42
Physics Degrees Awarded to Women	1	4	-	-	3	-	2	-	2
Physics Degrees Awarded to Black, Non-Hispanics	-	-	-	-	-	-	-	-	-
Physics Degrees Awarded to Hispanics	-	1	-	-	-	-	-	-	-
Physics Degrees Awarded to Native Americans	-	-	-	-	-	-	-	-	-
Total Physics Degrees Awarded to URM	-	1	-	-	-	-	-	-	-

Sources:
All degree data used in the institutional comparison graphs are presented as 3-year averages using the most recent three years of available data. Degree data is collected from the IPEDS Completion Survey by Race. IPEDS data is collected from every institution that participates in the federal student financial aid programs. Each school appoints a person to complete the IPEDS survey from which the data is gathered.

Data include all physics degrees as well as degrees that are frequently awarded in physics departments, such as engineering physics/applied physics, astrophysics, and physics teacher education. At institutions that have separate departments for e.g. applied physics or astrophysics, the data reflect the total number of degrees awarded in physics and allied departments.

Comparison of Undergraduate Physics Program with Florida International University

The following is a comparison of the undergraduate degree programs in physics at FIU and FAU.

BS in Physics

Admission: At both institutions, students must satisfy the University requirements. Also, a minimum GPA is required to transfer students.

FIU: Admissions criteria are the same as the general FIU criteria for students.

FAU: Admissions criteria are the same as the general FAU criteria for students.

Description:

FIU: "The B.S. degree prepares students for careers in research, industry, government, graduate study in physics, engineering, or material science."

FAU: "The Bachelor of Science (B.S.) degree program is the flagship of the Department's undergraduate curriculum. It is designed to help students prepare for careers in physics, related sciences or closely related fields such as engineering. The emphasis is on analytical methods in contemporary theoretical and experimental physics. Students considering graduate work in physics or related areas are strongly encouraged to complete this program."

Duration of program: 120 credits, both institutions.

FIU: 120 credits, 59 credits of physics courses, 15 mathematics courses and 8 general science courses. The completion of the remaining 38 credits must be done upon approval of their advisers.

FAU: 120 credits, 52 credits of physics courses, 15 mathematics courses and 8 general science courses. The completion of the remaining 45 credits must be done upon approval of their advisers.

Graduation

FIU: Students admitted to the university are admitted directly to their chosen major. Students are expected to make good progress based on critical indicators, such as GPA in specific courses or credits earned. In cases where students are not making good progress, a change of major may be required.

FAU: In addition to meeting University and College standards, students in any physics degree program must receive a grade of "C" or better in every required course offered within the Charles E. Schmidt College of Science.

Courses

FIU: Lower division courses (similar to FAU). However, FAU permits the student to take 8 credits in biology as opposed to 8 credits of chemistry. FIU has a Freshman Seminar course, whereas we offer biweekly talks to the UG's.

FAU: Lower division courses (similar to FIU).

FIU: Upper division required (similar to FAU). FIU offers two Modern Physics courses with Labs.

FAU: Upper division required (similar to FIU). FAU offers a Physical Electronics Laboratory. FAU offers a General Physics 3 course. Although FAU offers both Thermodynamics and Statistical Mechanics, we are in the process of merging these courses.

Both FAU and FIU offer a similar honors program for their BS degrees.

BA in Physics

FIU: BA in Physics prepares students interested in physics and planning to enter professional schools in business, education, journalism, law, and medicine, and for liberal arts students desiring a strong background in physical science but with career objectives in other Education. They offer a biophysics concentration, business concentration and an entrepreneurship concentration.

FAU: The Bachelor of Arts (B.A.) degree program is offered for students seeking exposure to analytical methods in contemporary physics within a broader, liberal arts-style curriculum. Course requirements are significantly reduced compared with the Department's flagship B.S. program.

The program offered by FAU does not include courses in the concentrations FIU offers. However, FAU offers a separate Bachelor of Arts in Education (B.A.E.) degree program is offered through the Department of Teaching and Learning in the College of Education. It is intended for students interested in teaching physics professionally at the secondary level. Students in this program will be advised through

the Department of Teaching and Learning. However, content-course requirements are listed here for students interested in this program.

Conclusion: the two BA's programs are comparable in the core physics courses; however, FIU offers three distinct concentrations.

Internships, Practicum, Study Abroad, Field Experiences

There has not been a demand for such a program from our students, nor an initiative from our faculty or administration. Although, we actively guide our UG students to apply for summer REU-type programs as well as government laboratory programs. We have numerous students each summer successfully attend REU programs or obtain student summer fellowships.

Pedagogy/Pedagogical Innovations

The Department's pedagogical approach to undergraduate education has evolved in several important ways over recent years. Highlights at the lower-division level include:

1. Introduction to Astronomy (AST 2002) is a large-enrollment, general education course that is part of the state university system's Intellectual Foundation Program (IFP). The course is offered both in traditional (face-to-face) and online versions.
    a. The traditional version has introduced a project that all students must complete using an online platform developed by FAU in collaboration with Google. The goal of this project is to stimulate scientific inquiry among the students.
    b. Students in the online course are required to watch a webcast of an astronomy lecture pitched at the general public, and to write a summary of it based on a specific rubric. The lecture selected has usually been from the Hubble Space Telescope Science Institute (STScI).
    c. The instructor has modified both the traditional and online versions of the course to use a continuous-evaluation assessment model. He has designed a pool of nearly 200 questions that form the basis of seven, 50-minute quizzes administered online throughout the semester to all students using the Blackboard platform.
    d. Students in the traditional courses are required to attend viewing sessions in the University's astronomical observatory. These sessions expose students to the practice of observational astronomy, and include both day and night sessions examining solar and stellar spectra. The Department has invested in the equipment needed to make these spectral observations possible.
    e. The instructor has also implemented an "early-warning" mechanism to track students that are at risk of failing the course, and intervene to make those students aware of that risk and advise them of the alternatives available to them.
    f. The Department now employs a senior, undergraduate Learning Assistant to help tutor students requesting help specifically in the Introduction to Astronomy course.

2. Physical Science (PSC 2121) will be redesigned and presented in a new format beginning spring 2015. The idea is to transform the classroom pedagogy from a teacher-centered format to a student-centered format. This will involve students to be more active in class, by including more hands-on activities, demos, and simulations. Students will also use their own electronic devices to access a program entitled Top Hat. This program is a new concept for class participation in Physical Science which allows them to access quick quizzes, power point questions, and other class related

information. All of these facets will increase and enhance learning, student engagement, and participation.

3. General Physics II (PHY 2049) has been redesigned to shift from a traditional lecture format to a "flipped classroom" model over the course of the semester. In-class lectures are gradually replaced with notes and other primary resources available online, and more class time is then devoted to problem solving using higher-order skills. Both students and the instructor report a more enjoyable, productive, and engaging experience.

4. Instructors in several courses, at both the lower- and upper-division levels, have shifted to using tablet computers when presenting lectures. Not only does this allow them to face the class continuously, thereby increasing student engagement, but it also frees the students to focus on the class instead of recording it in their own notes for later. Entire lectures are made available in PDF form, or even as YouTube videos, for later review.

The Department has also made strides in its approach to upper-division education for its undergraduate majors. Highlights include:

1. There was significant demand among undergraduate students, both within the physics majors and without, for an upper-division astronomy course. The Department has introduced Solar System Astronomy (AST 3110) to meet this demand. The course has been designed for students with various mathematical backgrounds, and has been well received as an upper-division elective by students from many majors.
2. Many undergraduate courses (*e.g.*, PHY 4604, PHZ 3113) have introduced a project-based component in their assessment of student performance. Doing so offers students some opportunity to work independently, or in small teams, on questions that are, to some extent, of their own design. They also gain valuable experience presenting results of that work. The purpose of this initiative is to provide a bridge for students from basic coursework into the University's Distinction Through Discovery undergraduate research program.
3. Several senior-level courses now include numerical and computer-aided visualization components. These courses use Mathematica, MatLab, C, and even simple numerical integration in an Excel spreadsheet to help familiarize students with modern, computational tools at their disposal.
4. The Department has created a lecture series targeted at its undergraduate majors wherein Physics graduate students present their research. This serves a dual purpose. First, it exposes undergraduate majors to the active research areas in the Department, helping them find ways to engage in the University's Distinction Through Discovery program. Second, it allows graduate students some practice teaching at a level higher than the lower-division introductory courses on which they typically work.
5. Several of the Department's courses (*e.g.*, PHY 3322, PHY 4323, PHY 4604) in recent years have been cross-listed with the Honors College in Jupiter. The necessity of broadcasting these courses to multiple locations has created a laboratory for developing methods of delivering advanced physics courses effectively at distance. Student in these courses have emphasized the benefit of having recorded lectures to review outside of class. The result is a partially "flipped" course model, with basic course material recorded or otherwise made available in advance, and more class time devoted to practice, problem solving, and discussion. Department faculty who have been involved in this effort have begun an informal process of comparing notes on effective techniques, and the hope is that this will lead eventually to a more effective, and more scalable, distributed model for advanced physics instruction.
6. Undergraduate participation in research is the key strategic focus of the University's Quality Enhancement Plan. A substantial effort by the department has been underway for the past few years to improve undergraduate research, especially in field experimental optics. The Department

of Physics has two optical laboratories with over 1000 square feet and three optics benches. The laboratories of quantum optics are equipped to exploit photon orbital angular momentum for quantum communication, optical tweezers to conduct research on manipulation of (cell like) micro objects and Raman spectrometer. Since 2010 nine students conducted research in quantum optics lab as Directed Independent Study (PHY 4095) or Special topic of Experimental Optics (PHY 4936). The results of each students research is presented at the annual undergraduate symposiums either as posters or invited talks. This has been done with very little funding, and we will be applying for more funding through the internal FAU Technology Fee Rrogram.

7. Some very important pedagogical changes the Department will make to its undergraduate programs have been planned but not yet implemented. This is primarily because of the need to balance the effort to create the new courses to be proposed with the ongoing effort to deliver our current core instructional and research programs effectively. At the undergraduate level, the keystone course in the revised curriculum will be the Undergraduate Seminar described above. This course will focus explicitly on career development and research skills for undergraduate Physics majors, including units on computational physics and written and oral communication.

(More pedagogical innovations are mentioned below in the section "Other Program Goals".)

Scope of Institutional Contributions

The 2013-2014 Intellectual Foundations Program (IFP) is FAU's implementation of the general education requirements for entering freshman. The Foundations of Science and the Natural World portion of the IFP requires that students complete six credits from the following list (two courses from two different departments and one course must have a lab.)

For Non Science Majors:

Anthropology Department
ANT 2511 **& L** ..... Intro to Biological Anthropology (4 cr incl. Lab)
Biology Department
BSC 1005 **& L** ..... Life Science (3 credits incl. Lab)
Chemistry Department
CHM 1020**C** ..... Contemporary Chemical Issues
CHM 2083 **(P/F)** ..... Chemistry in Modern Life **(Online Course)**
Engineering Dean Department
ETG 2831 ..... Nature: Inter. of Sc., Eng. and the Humanities
Geology Department
ESC 2070 ..... Blue Planet (**Online Course**)
GLY 2010**C** ..... Physical Geology (4 credits include lab)
GLY 2100 ..... History of Earth and Life
MET 2010 **& D** ..... Weather and Climate
Physics Department
AST 2002 **(P/F)** ..... Introduction to Astronomy
PSC 2121 ..... Physical Science

For Science and/or Engineering Majors:

Biology Department
BSC 1010 **& L & D** ..... Biological Principles (4 cr. incl. Lab & Disc)
BSC 1011 **& L & D** ..... Biodiversity (4 cr. incl. Lab and Discussion)
BSC 2085 **& L*** ..... Anatomy & Physiology I (4 credits incl. Lab)

Chemistry Department
CHM 2032 **& L** ..... Chemistry for Health Sciences (4 credits)
CHM 2045 **& L‡** ..... General Chemistry I (4 credits Incl. Lab)
Physics Department
PHY 2043** ..... Physics for Engineers I (3 credits)
PHY 2048 **& L**** ..... General Physics I (5 credits incl. Lab)
PHY 2053*** ..... College Physics I (4 credits)

** MAC 2281 or MAC 2311 is a prerequisite for this class. If a lab is needed take General Physics 1 Lab (PHY 2048 Lab).
*** MAC 1105 and MAC 1114 are prerequisites for this class. If a lab is needed take General Physics 1 Lab (PHY 2048 Lab).

IFP from https://www.fau.edu/uas/pdf/IFP_Curriculum.pdf

Service courses offered by the Department of Physics include the IFP courses above in black, together with PHY 2044 (College Physics 2, 4 credits), PHY 2049 & Lab (General Physics 2 with Lab, 5 credits), and PHY 2054 (Engineering Physics 2, 3 credits. The two one-credit lower level physics lab service courses (PHY 2048L, PHY 2049L) are take by all College Physics, Engineering Physics and General Physics students.

Student Profile

The following table (from the DDI) gives the student diversity and demographics of undergraduate physics majors, compared with college and university totals.

Undergraduate (Program CIP: 400801)		Physics		College Total	University Total
		2011-2012	2012-2013	2012-2013	2012-2013
American Indian/ Alaskan Native	Female	0	0	23	96
	Male	0	1	13	77
	Total	0	1	36	173
Asian or Pacific Islander	Female	0	1	247	776
	Male	2	2	145	664
	Total	2	3	392	1,440
Black (Not of Hispanic Origin)	Female	3	2	769	3,535
	Male	3	6	334	2,129
	Total	6	8	1,103	5,664
Hispanic	Female	0	2	952	3,922

Undergraduate (Program CIP: 400801)		Physics		College Total	University Total
		2011-2012	2012-2013	2012-2013	2012-2013
	Male	6	5	435	2,855
	Total	6	7	1,387	6,777
White (Not of Hispanic Origin)	Female	5	6	1,576	7,431
	Male	26	38	956	6,217
	Total	31	44	2,532	13,648
Non-Resident Alien	Female	3	2	87	318
	Male	0	2	30	294
	Total	3	4	117	612
Not Reported	Female	0	0	33	130
	Male	0	0	17	79
	Total	0	0	50	209
Total	Female	11	13	3,687	16,208
	Male	37	54	1,930	12,315
	Total	48	67	5,617	28,523

*Chart B4 b Majors Enrolled (Annual Headcount) By Gender and Ethnicity – under Instruction Data in the DDI

From this table one sees a diverse student body within a small department. There is a 40% increase in total UG physics majors.

The Department of Physics currently offers two undergraduate physics scholarships. The Undergraduate Award in Physics and the Excellence in Physics Scholarship are awarded each Spring semester and are $500 and $200, respectively. The Undergraduate Award in Physics is awarded based upon academic merit. The recipient must be a Junior or Senior in the program, have a 3.0 GPA, and must be an active participant in research. The Excellence in Physics Scholarship is awarded based upon academic excellence and merit in Physics. The recipient must be a Junior or Senior in the program and be in good standing with the University.

At the beginning of each semester if we do not have enough Graduate Teaching Assistants to cover all of the grading/tutoring/proctoring assignments for the general level physics lecture courses, we hire upper level undergraduate students to fill the void. They are allowed to work at an hourly wage for a maximum of 10 hours per week with the Professor they are assigned to. By allowing them to work this minimal number of hours they are able to focus on their own studies while further integrating themselves into the Department and establishing a network of support for themselves, both academically and financially.

Advising Procedures

Advising of undergraduate science majors is centralized in the Charles E. Schmidt College of Science Student Services Office. The advisor assigned to physics majors works closely with faculty in the Department of Physics to ensure that students are given correct information.

Advising begins at orientation in the CESCOS Student Services Office and includes:
- Evaluation if IFP/General Education and Language Requirements.
- Initial advising for foundational coursework in the major: Calculus 1, 2, and 3, Chemistry, Biology, an additional mathematics requirements.
- Evaluation application of transfer credits if necessary. Complicated or atypical situations are evaluated with assistance from the departmental faculty advisor.
- Guidance in minors and certificates appropriate to vocational career objectives.

Ongoing advising occurs in the CESCOS Student Services Office for at least two semesters; this includes:
- Follow up on IFP/General Education and Language Requirements.
- Recommendations for required core courses.
- Referral to faculty advisors (generally after foundational coursework is near completion)
- Continued guidance in minors and certificates appropriate to vocational career objectives.

The CESCOS Student Services Office continues to serve as a resource for clerical and administrative advising functions, guidance in minors and certificates appropriate to vocational career objectives, and any related advising issues of a general nature.

Students are periodically directed to seek departmental faculty advising for advanced coursework, electives, and research opportunities. In addition, departmental faculty advising is performs the final audit of major specific requirements in math, general science, and physics before graduation.

Licensure Rates

There is no licensing program for physics.

Placement Rates/Employment Profile

The Department of Physics does not collect or receive placement data for undergraduate physics majors.

Retention rates

The following tables (from IEA) show retention (and graduation) rates for FTIC undergraduate physics majors through second and fourth years, since the year 2000.

Outcomes through year 2		Entering Year												
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	#	3	6	8	6	11	5	7	6	7	1	11	13	-
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
Graduate @ FAU	#	-	-	-	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-	-	-	-
Graduate @ other SUS Institution	#	-	-	-	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-	-	-	-

Outcomes through year 2		Entering Year												
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Persist	#	3	5	4	3	7	4	6	4	6	1	8	-	-
	%	100.0	83.3	50.0	50.0	63.6	80.0	85.7	66.7	85.7	100.0	72.7	-	-
Transfer to other SUS	#	-	-	1	1	1	-	1	-	-	-	-	-	-
	%	-	-	12.5	16.7	9.1	-	14.3	-	-	-	-	-	-
Leave	#	-	1	3	2	3	1	-	2	1	-	3	-	-
	%	-	16.7	37.5	33.3	27.3	20.0	-	33.3	14.3	-	27.3	-	-

Outcomes through year 4		Entering Year												
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	#	3	6	8	6	11	5	7	6	7	1	11	13	-
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
Graduate @ FAU	#	-	2	2	-	-	1	3	-	-	-	-	-	-
	%	-	33.3	25.0	-	-	20.0	42.9	-	-	-	-	-	-
Graduate @ other SUS Institution	#	-	-	1	-	-	-	-	-	-	-	-	-	-
	%	-	-	12.5	-	-	-	-	-	-	-	-	-	-
Persist	#	3	2	1	2	6	3	3	2	2	-	-	-	-
	%	100.0	33.3	12.5	33.3	54.5	60.0	42.9	33.3	28.6	-	-	-	-
Transfer to other SUS	#	-	-	1	1	1	-	1	-	3	-	-	-	-
	%	-	-	12.5	16.7	9.1	-	14.3	-	42.9	-	-	-	-
Leave	#	-	2	3	3	4	1	-	4	2	-	-	-	-
	%	-	33.3	37.5	50.0	36.4	20.0	-	66.7	28.6	-	-	-	-

Graduation rates

The following table (from IEA) shows the six-year graduation rate for FTIC undergraduate physics majors, since the year 2000.

Outcomes through year 6		Entering Year												
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	#	3	6	8	6	11	5	7	6	7	1	11	13	-
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-
Graduate @ FAU	#	2	3	3	1	4	3	5	-	-	-	-	-	-
	%	66.7	50.0	37.5	16.7	36.4	60.0	71.4		-	-	-	-	-
Graduate @ other SUS Institution	#	-	-	2	1	-	-	1	-	-	-	-	-	-
	%	-	-	25.0	16.7	-	-	14.3	-	-	-	-	-	-

Outcomes through year 6		Entering Year												
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Persist	#	1	1	-	1	2	-	1	-	-	-	-	-	-
	%	33.3	16.7	-	16.7	18.2	-	14.3	-	-	-	-	-	-
Transfer to other SUS	#	-	-	-	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-	-	-	-
Leave	#	-	2	3	3	5	2	-	-	-	-	-	-	-
	%	-	33.3	37.5	50.0	45.5	40.0	-	-	-	-	-	-	-

The following table (from IEA) shows the four-year graduation rate for undergraduate physics majors transferring from a Florida public community college (with or without an AA degree), since the year 2001

Outcomes through year 4		Entering Year											
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total	#	1	1	-	2	-	2	1	3	4	4	2	5
	%	100.0	100.0	-	100.0	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Graduate @ FAU	#	-	1	-	1	-	1	-	2	3	-	-	-
	%	-	100.0	-	50.0	-	50.0	-	66.7	75.0	-	-	-
Graduate @ other SUS Institution	#	-	-	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-	-	-
Persist	#	1	-	-	1	-	-	1	-	1	-	-	-
	%	100.0	-	-	50.0	-	-	100.0	-	25.0	-	-	-
Transfer to other SUS	#	-	-	-	-	-	-	-	-	-	-	-	-
	%	-	-	-	-	-	-	-	-	-	-	-	-
Leave	#	-	-	-	-	-	1	-	1	-	-	-	-
	%	-	-	-	-	-	50.0	-	33.3	-	-	-	-

The following table (from IEA) shows the total number of BA/BS degrees in physics awarded, by year, since 2001-2002. (A degree awarded with a single major contributes one degree, and a double major contributes one-half degree.)

	Year Degree Granted													All
	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	
Single major	5	4	3	8	8	3	2	8	3	7	3	2	6	62
Double major	0	0.5	0	0	0	0	1.5	0	0	0	0	0	0	2
Total	5	4.5	3	8	8	3	3.5	8	3	7	3	2	6	64

These tables were found to be inconsistent, and we cannot draw any meaningful conclusions from them. In particular retention and graduation rates are incorrectly calculated (we found 100% errors).

Student Recruitment

On its web page, the department offers students information on research and other related information (SPS, Observatory, Events etc.) for those pursuing a BA/BS in Physics. More focus can be made here to welcome new prospective students through our website. We currently do not have the resources to implement or maintain a high-quality web design for the department.

Prospective students are also contacted by phone by faculty members to encourage them to become BA/BS Physics students at FAU. The Department of Physics offers a numerous events and outreach activities designed to increase interest in physics, and inspire local elementary, middle and high school students to pursue careers in physics at FAU. Some of these outreach activities are highlighted in Section E of this report on Service and Community Engagement. They include:

The Observatory's Outreach: The Department's Astronomy Observatory's Outreach efforts try to connect the public with astronomy in many ways. We attract over 500 guests per year.

Annual Physics Carnival and Pumpkin Drop: Since 2007, the Physics Department hosts its Annual Physics Carnival and Pumpkin Drop every Halloween. This is our major community outreach effort that exposes approximately 300 middle school children to basic physics principles at an early age.

Gumbo Limbo Nature Center: Our efforts here involve giving talks about the issue to various nature centers and libraries across the county, such as Gumbo Limbo Nature Center in Boca Raton, Green Cay Nature Center in Boynton Beach, almost every public library the county offers, including various departments inside FAU as well.

Dark Sky: We have collaborated with Palm Beach County's Dept. of Environmental Resources Management, their Parks and Recreations Dept., Gumbo Limbo, and Okeeheelee Nature Center in West Palm Beach to create Palm Beach County's Dark Sky Festival in late winter. Our third and biggest event yet will be held in February 2015 with an expected attendance to reach over 2,000 visitors

Astronomical Society of the Palm Beaches: Every professor and Observatory staff scientists in FAUST has given a public lecture on general relativistic astrophysics and cosmology.

Proposed Traveling Physics Group: This traveling group would bring hands-on physics demonstrations to the local middle schools and high schools.

Frontiers in Science: Every Spring semester the Charles E. Schmidt College of Science holds a lecture series that is open University-wide and to the general public. The Physics Department has participated in this lecture series both with internal speakers and invited physics speakers every term since its inception.

Science Olympiad: Every Spring, the Charles E. Schmidt College of Science hosts the Southeast FL regional qualifier for the national Science Olympiad competition. On the day of this event, there are as many as 600 students on campus that are exposed to science. Faculty and students in the Department of Physics play crucial roles in event organization, supervision and judging. In fact, it is Physics Department policy that all new Graduate Students serve as volunteers in their first Spring semester. It is such an enjoyable experience for our Graduate Students that they tend to volunteer in subsequent years.

2. Graduate Programs and Courses

At the graduate level the Department offers an MS, MST, PSM in MP, and PhD degree programs. In particular, its graduate programs lead to the Master of Science (M.S.), Master of Science in Teaching (M.S.T.) and Doctor of Philosophy (Ph.D.) degrees. The Department also offers a newly-accredited professional graduate program in Medical Physics leading to the Professional Science Master (P.S.M.) degree.[1]

Assessment and Program Improvement

The assessment program is in continuous improvement mode; no changes are planned at this time.
In early Spring 2015, the faculty in the department and department assessment representative will work with the college assessment director to:
1) Redefine student learning outcomes for this program;
2) Identify new outcome assessments and evaluation tools in the program;
3) Introduce/implement rubrics to help better quantify student success for each outcome

MS program.

The Department of Physics encourages students to enroll in its Ph.D. program instead of targeting an MS degree. Consequently, during the past years no or very few students were seeking a Master as their terminal degree and meaningful assessment data is not available. This is also the case for the MST program where no students were recently enrolled.

Ph.D. program.

Assessment of SLOs in the BS/BA programs is performed using three Outcomes:

1. Those students who successfully obtain the doctorate degree in Physics have profound knowledge in the core areas of physics. During their first two years in the program the students should complete the core courses and take their qualifying exams, identify a faculty advisor and start a guided research project. Declarative knowledge in the Ph.D. program is assessed when students finish their second year and take the qualifying examinations in the four core areas of physics: mechanics, electromagnetism, quantum mechanics and statistical physics. From these exams only a pass or fail is reported to the students but for assessment purposes a score is given to each individual exam and student, which clearly reflects their knowledge or lack thereof in the core areas. Faculty members responsible for the exams are constantly monitoring these outcomes and they are also documented in the annual student report.

2. Graduates will be well prepared and hence competitive for research and/or teaching positions in their field. Students have access to state of the art experimental and computational facilities and are encouraged and supported by faculty to interact with leading scientists in their fields. Job statistics are evaluated by the percentage of graduates obtaining positions in the field and the quality of those positions.

3. Doctoral graduates will have the ability to communicate orally scientific methods, findings and their importance. Students are encouraged to present their work as a poster or talk at scientific meetings, the Annual Charles E. Schmidt College of Science Research Day and in Departmental Colloquia, and to participate in appropriate academic and social activities. Where possible, presentations are supervised and evaluated by the faculty advisor who also reviews a draft of the poster and provides feedback on the

[1] The PSMMP program was awarded CAMPEP accreditation in Summer 2014.

poster presentation. Successful participation is evaluated using a standardized evaluation form. On this sheet the instructor and/or other faculty member judges the presentation as "Outstanding", "Good", "Acceptable", "Poor" or "Unacceptable" for the following criteria: - Content - Organization - Delivery - Visual Aids.

PSMMP program.

The assessment of this newly accredited program is based on the following three outcomes:

Outcome 1: Description & Methodology

Students will engage with professional organizations and activities in Medical Physics in the course of their Practicum and Research.

FAU Strategic Plan related goals & objectives:
Goal 1, Objective 2: Foster institutional commitment to student satisfaction and success.
Goal 2 (all objectives): Meeting Statewide Professional and Workforce Needs.
Goal 4 (all objectives): Meeting Community Needs and Fulfilling Unique Institutional Responsibilities.
Goal 7, Objective 1: Showcase University accomplishments internally to faculty, staff and students.
Goal 7, Objective 2: Showcase University accomplishments externally to local, regional, national and international audiences.

Implementing Strategy:
Information on student participation in professional societies and organizations, interaction with faculty and/or professional medical physicists, and participation in professional medical physicists workshops and/or conferences, will be collected by means of an online survey that will be completed by students each academic year.

Assessment Method:
The analyses and summary of the percentage of students reporting participation in specific professional activities will be reviewed annually by the Director of the MSMP program and participating faculty and medical physicists.

Criterion for success:
1) Participation in professional societies and organizations:
95% of MSMP students will participate in one or more professional societies or organizations.
2) Interaction with faculty and/or professional medical physicists:
95% of MSMP students will interact with faculty and/or professional medical physicists weekly or more often.
3) Participation in professional medical physicists workshops and/or conferences:
95% of MSMP students will participate in one or more workshops and/or conferences.

Results:
1) 17 of the 18 students have joined the AAPM (American Association of Physicists in Medicine. (The program director writes the attestation letters) (94.4%).
2) All PSMMP students interact with faculty and/or professional medical physicists weekly or more often (100%).
3) All PSMMP students have participated in medical physicists workshops and/or conferences (100%).

Outcome 2: Description & Methodology

Students will provide an in-depth analysis of their knowledge in Medical Physics through research for Master's Thesis. Students will demonstrate:
1) Current knowledge of their field of study and the ability to critically review and interpret scientific literature.
2) Ability to develop hypothesis, design and perform scientific experiments, and draw logical conclusions from data.
3) Ability to write scientific reports and communicate effectively in oral presentations.

FAU Strategic Plan related goals & objectives:

Goal 1, Objective 10: Award graduate and undergraduate degrees in targeted and non-targeted areas consistent with Board of Trustees-approved Board of Governors Accountability Targets.
Goal 2, Objective 4: Establish ongoing University-level evaluation of emerging workforce needs and ensure FAU's response to those needs.
Goal 3, Objective 1: Increase significantly the University's total research expenditures to expand and enhance national international recognition of FAU's academic and research programs.
Goal 7, Objective 1: showcase University accomplishments internally to faculty, staff and students.

Implementing Strategy:

Evaluation of student Thesis work in the PSMMP program will be performed by the Thesis Committee in accordance with the guidelines of the Physics Department. The Thesis Committee consists of Faculty and Medical Physicists. The Committee reviews the defense presentations, which are open to all Faculty and students.

Assessment Method:

At the beginning of the second year, after the student will have completed the Practicum at one of the partner hospitals, he or she will discuss the proposed thesis subject with the Thesis Committee. Committee members grade the student's proposed thesis subject as "*satisfactory*" or "*unsatisfactory*" using the following criteria:
1) Scientific Merit of Study
Grade is based on published research interest.
2) Adequacy of literature review
Grade is based on the coverage of the literature.
3) Ability to create testable hypothesis and define objectives
Grade is based on the student's discussion of the proposed project
4) Soundness of research methods
Grade is based on the selection of research methods.
5) Oral communication
Grade is based on the student's presentation and discussion of the selected project.
During the last semester of study, each student submits a final written Thesis and presents a Thesis defense seminar. Each member of the Thesis Committee evaluates the Thesis as "*satisfactory*" or "*unsatisfactory*" in each of the following criteria:
1) Scientific Merit of Study
Evaluation is based on the relevance of the Thesis to current scientific interests in the field of study.
2) Critical analysis of literature in the field
Evaluation is based on the coverage of related scientific questions.
3) Hypothesis and extent to which objectives are met
Evaluation is based on how the hypothesis is related to the results of the research project.

4) Scope and quality of data collected and presentation
Evaluation is based on the student's ability to collect and critically present the research's outcome.
5) Intellectual merit of data interpretation and analysis
Evaluation is based on student's ability to draw the right conclusions from the research's results.
6) Potential for journal publication from the work
Evaluation is based on *if* the Thesis results are publishable and *where.*
Criterion for success
1) Success criterion for Thesis proposal:
At least 95% of the students' proposed thesis project will be accepted by the Thesis Committee.
2) Success criterion for Thesis defense:
At least 95% of the students will successfully defend their Thesis as assessed by the Thesis Committee, Faculty and Medical Physicists.

Results Outcome 2:

1. Six PSMMP students have proposed their Thesis project. All accepted by the Thesis Committee (100%).
2. One student has successfully defended his Thesis and graduated, summer 2013. Four students have graduated with a Professional Science Masters (100%).

Outcome 3: Description & Methodology

Students in the PSMMP program will be prepared for professional positions in a Hospital, Cancer Center, or health related industry. Career paths for Medical Physicists include: (1) Radiation Therapy (2) Diagnostics (3) Nuclear Medicine (4) Health Physics (5) Academia (6) Companies that produce treatment equipment, treatment planning systems, and support materials. The PSMMP program provides specialization in Radiation Therapy.

FAU Strategic Plan related goals & objectives:

Goal 1, Objective 2: Foster institutional commitment to student satisfaction and success.
Goal 2 (all objectives): Meeting Statewide Professional and Workforce Needs.
Goal 4 (all objectives): Meeting Community Needs and Fulfilling Unique Institutional Responsibilities.
Goal 4 Objective 2: Provide a point for community contact that will serve as a clearinghouse for University outreach initiatives that satisfy community needs and unique institutional responsibilities.
Goal 3: Building world-class academic programs and research capacity
Goal 5: Increasing the University's visibility.

Implementing Strategy:

The PSMMP is an interdisciplinary program; the courses are offered from Faculty within three Colleges: Charles E. Schmidt College of Science, Charles E. Schmidt College of Biomedical Science, and College of Engineering and Computer Science.
On the site experience is offered through the Practicum and Thesis Research. Fully board certified Medical Physicists working in the area Hospitals train the students. Partnerships are set between four Hospitals/Cancer Centers (Boca Raton Regional Hospital, Wellington Regional, Broward Health, South Florida Radiation Oncology) and FAU for the clinical training of the students.
Three companies (Nucletron, Best Medical International and SERNOX) provide relevant computer codes.
The PSMMP program will maintain contact with the graduates through the Program Director, Faculty Advisors and annual email surveys.

Assessment Method:

Students will be prepared to perform as professional Medical Physicists.
During the second year the MSMP students will participate and present results of their research at relevant conferences.
An exit-review with each graduating student will be established.
A system for tracking post-graduation and data collection through email will be maintained within the Professional MSMP Program.

Criterion for Success:

1) At least 98% of the graduates that will seek employment in the field will be able to obtain employment within one year from graduation.
2) At least 95% of the students will be taking the first board examination while working as Medical Physicists in training.
3) At least 90% of the students will be presenting research papers at conferences prior graduation.

Results:

1) Three graduates are employed within a few months of graduation: two of them as Clinical Medical Physicists and one in Medical Equipment Industry. One graduate is continuing at FAU towards a PhD degree (100%).
2) One of the graduates has passed all three levels of American Board of Radiology (ABR) examinations. One graduate has passed the American Board of Medical Physicists (ABMP) examination (50%).
3) All students have presented research papers at conferences prior graduation (100%)

Program Improvement:

Two required courses have been added to the MSMP program increasing the number of credit hours from 37 to 41:

- The course RAT 6376 *Shielding and Commissioning* (3c.h.)
- The course RAT 6932 *Seminar in Medical Physics* (1 c.h.)

Two courses have been modified and renamed:

- RAT 6616 Medical Imaging Physics
- RAT 6687 Nuclear medical Physics

One course has been added to the electives:

- PHZ 5715 Introduction to Biophysics
- The medical physics laboratory is equipped with 5 workstations and the Oncentra
- Treatment Planning program with multiple licenses. Students practice on treatment planning as part of the Radiation Therapy courses RAT 6628 and RAT 6629.
- Starting 2013 only students from accredited medical physics programs are allowed to sit in the American Board of Radiology examinations. Accreditation application to the Commission on Accreditation of Academic Medical Physics Education Programs (CAMPEP) was submitted October 2012. A document responding to the CAMPEP comments was submitted in January 2013.

One position for a tenure track position was advertised at the AAPM site. One Medical Physicist was hired as a Visiting Assistant Professor. More positions will open next year.

Admission Criteria

For admission into the doctoral program, applications are evaluated individually, but the following credentials are required:

- A Bachelor of Science degree in Physics with at least 3.0 GPA (or equivalent). For Applicants without a Bachelor's degree with a major in Physics, it is required that they have course work in physics equivalent to a Bachelor of Science degree in Physics.
- Three letters of recommendation documenting the applicant's prior work in physics focusing on preparation and suitability for success in graduate-level physics courses and self-motivated research.
- The general GRE test is required, and the GRE subject test in physics is recommended. These are important tools for gauging the academic ability and academic preparation of students in an objective way. There is no minimum score required, but the competitive nature of the admissions process generally ensures relatively high scores on the general GRE test.
- A transcript of their prior academic work.

For admission into the Professional Science Masters program in Medical Physics, the formal criteria are identical, except that candidates with a B.S. in Biology, Chemistry, Computer Science or Engineering with a minor in Physics are also considered.

For admission into the M.S.T. program, the formal criteria are again identical, except that only a B.A. in physics or its equivalent is required.

Enrollment information

Headcount:

Annual Headcount (Program CIP: 400801)	Physics		College Total	University Total
	2011-2012	2012-2013	2012-2013	2012-2013
Masters/Specialist	3	1	228	4,675
Doctoral	27	25	279	927

State-fundable FTE:

Annualized Graduate State-Fundable FTE		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Graduate Total		23.3	21.4	18.1	228.2	2,223.7
Grad I		3.5	4.9	4.8	98.5	1,838.4
Grad II		19.8	16.5	13.3	129.7	385.2
Classroom		14.4	15	13.3	183.2	2,085.9
Thesis-Dissertation		8.8	6.4	4.8	45.1	137.7

*Chart C1 Annualized State-Fundable FTE Produced By Level under Productivity Data from DDI Data

Annualized Graduate State-Fundable FTE Produced In/Out of Department/College	Physics			College of Science	University Total
	2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
FTE produced by students who are:					
Majors within the department	22.1	21	16.4	188.3	1,730.7
Majors outside the department, but within the college	0.3		0.8	17.0	348.5
Majors outside the college	.8	.5	.9	22.9	144.4
Total	23.3	21.5	18.1	228.2	2,223.7

*C2 Annualized State-Fundable FTE Produced In/Out Of Department or College under Productivity Data from DDI Data

Average Class Size and Faculty/Student Ratio

Graduate Classes		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Type					692	5,154
Lecture/ Seminar	# Sections	20	20	20	167	1,575
	# Enrolled	111	127	122	1,386	22,406
	Avg Section Enrollment	5.6	6.4	6.1	8.3	14.2
	# Faculty Taught	15	15	15	158	1,318
	% Faculty Taught	75	75	75	94.6	83.7
Lab	# Sections				1	42
	# Enrolled				20	465
	Avg Section Enrollment				20.0	11.1
	# Faculty Taught				1	26
	% Faculty Taught				100.0	61.9
Other Course Types	# Sections	28	33	35	756	1,951
	# Enrolled	103	104	79	1,080	4,840
	Avg Section	3.7	3.2	2.3	1.4	2.5

Graduate Classes		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
	Enrollment					
	# Faculty Taught	28	33	33	703	1,831
	% Faculty Taught	100.0	100.0	94.3	93.0	93.8

*Chart B3 Average Course Section Size and Percent of Sections Taught By Faculty under Instruction in DDI Data

Graduate Physics Curriculum

MASTER'S PROGRAMS

Master of Science with Major in Physics

The Physics Department offers the Master of Science (M.S.) degree with major in Physics. The degree should be particularly attractive to those whose career paths point to a job in industry or to teaching at the high school or community college level. The coursework and research experience provided by the Master of Science program will also be of value to students whose eventual goal is a Ph.D., although those students are encouraged to enroll directly into the Ph.D. program if possible. The Master of Science degree normally requires four or more semesters after completing the Bachelor of Science requirements.

Admission Requirements
In addition to meeting all of the University and College admission requirements for graduate study, applicants for the Master of Science degree must meet all of the following the Departmental requirements:

1. A B.S. degree in Physics;

2. Have taken the general portion of the GRE. No minimum score is required. (GRE scores more than five years old will not be accepted);

3. A 3.0 average or higher for the last 60 credits of undergraduate work;

4. Approval from the Department of Physics; and

5. For any student from a non-English-speaking country, a minimum score of 550 (CBT-213) on the TOEFL exam.

Degree Requirements - Thesis Option

Mechanics	PHY 6247	3
Electromagnetism	PHY 6346	4
Statistical Mechanics	PHY 6536	4

Quantum Mechanics 1	PHY 6645	3
Thesis	PHY 6971	7
Mathematical Physics	PHZ 5115	3
Electives*		6
Total		**30**

Degree Requirements - Non-Thesis Option

Mechanics	PHY 6247	3
Electromagnetism	PHY 6346	4
Statistical Mechanics	PHY 6536	4
Quantum Mechanics 1	PHY 6645	3
Mathematical Physics	PHZ 5115	3
Electives*		13
Non-Thesis Master's applicants must pass a written or oral examination administered by the Department.		
Total		**30**

* Approved by the graduate advisor.

Note: A maximum of 3 credits in Graduate Research (PHY 6918) will normally be allowed.

Master of Science in Teaching (Physics)

The Master of Science in Teaching (M.S.T.) is designed for physics teachers in secondary schools and community colleges. The cognate area will usually be Mathematics.

Admission Requirements
In addition to meeting all of the University and College admission requirements for graduate study, applicants for the M.S.T. degree must meet all of the following Departmental requirements:

1. A B.A. in physics or its equivalent;

2. Have taken the general portion of the GRE. No minimum score is required. (GRE scores more than five years old will not be accepted);

3. A 3.0 GPA or higher in the last 60 credits of undergraduate work; and

4. Approval from the Department of Physics.

Degree Requirements

Electromagnetism 2	PHY 4324	3

Undergraduate Laboratory	PHY 4811L	2
Topics in Physics	PHY 5935	6
Master's Thesis (or additional 6000-level Physics Electives)	PHY 6971	6
Electives		6
Education Courses		6
Total		**30**

Professional Science Master with Major in Medical Physics

The Professional Science Master with major in Medical Physics degree is an innovative program that develops advanced scientific knowledge and professional skills. The program is interdisciplinary and provides hands-on learning through on-site training. It aims to engage students with professional goals and help them become scientists uniquely suited to the 21st-century workplace.

Medical physics is an applied branch of physics devoted to the application of concepts and methods from physics to the diagnosis and treatment of human disease. A qualified medical physicist is competent to practice independently in one or more of the subfields (tracks) of medical physics.

The Medical Physics program requires 41 credits (plus the 3-credit prerequisite course, PCB 3703). It provides professional training in partnership with area hospitals focusing on the medical physics radiation therapy track, which employs approximately 75 percent of the medical physicists.

Admission Requirements
In addition to meeting all of the University and College admission requirements for graduate study, applicants for the Medical Physics program must meet all of the following Departmental requirements:

1. A B.S. in Physics. Candidates with a B.S. in Biology, Chemistry, Computer Science or Engineering with a minor in Physics are considered;

2. At least a 3.0 (of a 4.0 maximum) GPA in science and mathematics courses;

3. Have taken the general portion of the GRE. No minimum score is required. (GRE scores more than five years old will not be accepted);

4.Successful completion of the prerequisite course PCB 3703, Human Morphology and Function 1;

5. Approval from the Department of Physics.

Degree Requirements

Core Courses (15 credits)		
Radiation Physics	RAT 6686	3
Introduction to Radiation Biology	BSC 6834	3
Radiation Therapy Physics	RAT 6628	3

Medical Imaging Physics	RAT 6616	3
Introduction to Nuclear Physics	RAT 6687	3
Additional Required Courses (23 credits)		
Advanced Photon Beam Radiation Therapy	RAT 6629	3
Radiation Therapy: Clinical Practicum and Shadowing	RAT 6947	3
Bioinformatics: Bioengineering Perspectives	BME 6762	3
Shielding and Commissioning	RAT 6376	3
Seminar in Medical Physics	RAT 6932	1
Graduate Research	PHY 6918	3
Master's Thesis	RAT 6975	7
Elective Course (3 credits) ***Choose one course from the following with advisor's approval:***		
Biostatistics	STA 5195	3
Introduction to Dynamical Systems and Chaos 1	MAP 6211	3
Advanced Cell Physiology	PCB 6207	3
Special Topics (including Cell Structure and Function)	BSC 6936	3
Introduction to Biophysics	PHZ 5715	3
Total		**41**

DOCTORAL PROGRAM

Doctor of Philosophy with Major in Physics

The Physics Department offers the Ph.D. degree in Physics with a research options in astrophysics, condensed matter physics, mathematical physics and computational physics. The Ph.D. will be conferred only for work of distinction in which the student displays original scholarship, achievement and ability. The degree will not be awarded solely on the basis of study, however fruitful or for any prescribed period of time.

Admission Requirements
Admission requirements for the doctoral degree in Physics are the same as for the M.S. degree in Physics.

Degree Requirements *(minimum of 80 credits)*
1. Ph.D. students must meet all degree requirements and physics course requirements for the M.S. degree.

2. Additional course requirements are:

Electromagnetic Fields	PHY 6347	3
Quantum Mechanics 2	PHY 6646	3

Graduate Colloquium	PHY 6920	1
Physics Electives		12

At least 12 credits of the total 18 required for the M.S. and Ph.D. programs must be from physics courses at the 6000 level approved by the graduate advisor.

3. The final requirement id dissertation coursework.

Dissertation	PHY 7980	30

The Department may accept up to 30 transfer credits into the program at the discretion of the Department graduate advisor.

Admission to Candidacy
Before students are admitted to candidacy, they must demonstrate mastery of the broad areas of physics covered in the undergraduate and first-year graduate programs. This will be tested by means of a comprehensive written examination covering classical and modern physics. This examination will usually be scheduled at the end of the summer/beginning of fall semester after the first year of graduate work and may be attempted twice at most.

Dissertation Advisor and a Supervisory Committee
When students have been admitted to candidacy, they must choose a departmental faculty member who is willing to serve as dissertation advisor. A supervisory committee is then requested with the approval of the Department graduate advisor. Once approved, the committee meets with the student to approve a preliminary plan of study and dissertation topic.

Doctoral Research
Candidates must complete a significant program of original research, a directed independent study in general theory and participate in advanced seminars in their area of specialization, culminating in a dissertation and a final oral examination. The dissertation must add to the sum of existing knowledge and be expressed with literary skill and clarity. The student's supervisory committee, the Department Chair, the Dean of Science and the Graduate College, must approve the completed dissertation.

Comparison with FIU as peer institution: FIU has three time the number of T/TT faculty that we have, twice the total faculty. They do not have a Professional Masters in Medical Physics but they do have a research group in this area. FIU supports a broad spectrum of experimental and theoretical topics including, astronomy, atomic molecular and optical physics, biophysics, condensed matter physics, nuclear physics experiment, medium energy nuclear theory, neuroimaging and medical physics, experimental plasma physics, experimental particle physics as well as physics education research. FIU on the other hand offers graduate research in five areas neuroscience, soft condensed matter physics, experimental X-ray power diffraction, classical and quantum general relativity, medical physics, physics education, and numerical condensed matter physics.

The admission requirements for our two programs are essentially similar as well as the two PhD course requirements. Our program offers a non-thesis MS degree in Physics, while FIU offers only the thesis option. FAU offers a PSM in Medical Physics FIU does not at this time

Internships, Practicum, Study Abroad, Field Experiences

Internships, practicums, study abroad or field experiences are not part of the PhD, MS or MST programs at FAU's Department of Physics. However, the PSMMP explicitly includes summer internships at local hospitals as part of the degree requirements. Studies abroad and field experiences are currently not an explicit part of the graduate program. If a student is interested in taking some credits at a different institution (possibly out of the country), this needs to be discussed on a case-by-case basis.

Pedagogy/Pedagogical Innovations

The graduate classes within the Department of Physics is at this point taught in a traditional lecture/discussion style, which seems an adequate approach for teaching advanced physics courses. We are beginning to introduce course-based projects into our Mathematical Physics course utilizing more technology, but online components and computer-based projects remain an exception.

Dr. Leventouri enhances the students' education by integrating her X-ray Diffraction research Laboratory (SE 140) into the program of the PSMMP students. X-ray radiation Lab is complementing the course-based student's learning on required courses of the program. In addition, along with her colleagues, she introduces undergraduate students of upper level Physics courses in course-based fundamental methods of x-rays radiation education and research.

Scope of Institutional Contributions

Service courses of the department focus on the undergraduate level. However, it is not unusual to have a student majoring in a different department in a graduate or UG course — specifically in quantum mechanics or biophysics.

Student profile

The Department of Physics currently offers one graduate physics scholarship. The Nathan W. Dean Award is awarded every spring semester and is $500. This award is based on the number of publications submitted, conference presentations, awards, posters and talks given by the applicants.

The following tables (from DDI) give the student diversity and demographics of graduate physics majors compared with college and university totals.

Graduate (Program CIP: 400801)		Physics		College Total	University Total
		2011-2012	2012-2013	2012-2013	2012-2013
American Indian/ Alaskan Native	Female			2	11
	Male				8

Graduate (Program CIP: 400801)		Physics		College Total	University Total
		2011-2012	2012-2013	2012-2013	2012-2013
	Total			2	19
Asian or Pacific Islander	Female			14	155
	Male			13	119
	Total			27	274
Black (Not of Hispanic Origin)	Female			10	624
	Male	1	1	20	265
	Total	1	1	30	889
Hispanic	Female			27	495
	Male			25	318
	Total			52	813
White (Not of Hispanic Origin)	Female	2	2	158	1,926
	Male	10	8	143	1,233
	Total	12	10	301	3,159
Non-Resident Alien	Female	3	2	38	177
	Male	21	15	53	200
	Total	24	17	91	377
Not Reported	Female			4	41
	Male				30
	Total			4	71
Total	Female	5	4	253	3,429
	Male	32	24	254	2,173
	Total	37	28	507	5,602

*Chart B4b Majors Enrolled (Annual Headcount) By Gender and Ethnicity under Instruction in DDI Data

From these tables one sees a poor representation of female students, as well as black or Hispanic students. This imbalance is an issue that the physics department will want to address by more actively recruiting female and minority graduate students. We recruit the majority of our students from overseas that gives us a very diverse ethnic background. Our best candidates come from overseas or South America. It has proven difficult to recruit US students to the FAU PhD physics program. This could account for this discrepancy.

At the time of writing this text, 27 Ph. D. students are supported through a Graduate Teaching Assistantship (GTA). Support in the form of a GTA through federally funded research projects is still the exception, and the typical Ph.D. student's work obligations consist of tutoring and mentoring. Graduate students are actively involved in writing publications, including both conference and journal publications. A main challenge with journal publications remains the long processing time of submissions to journals. The Department has had success sending its graduate students to numerous professional meetings this year. The Chair has the policy of matching Graduate Student Association (GSA) grants (typically $600 per meeting) for students presenting a poster, talk or paper at a meeting. Professor Engle and Miller use their federal funding to send their PhD students to conferences and meetings. The Chair has established a stable and funded research effort with the Air Force Research Laboratory's Information Directorate in Rome, NY. Each year for the past five years, Dr. Miller has taken at least two FAU students (both UG and Graduate) students to AFRL/RI for summer fellowships under the Visiting Faculty Fellowship Program or the AFOSR Summer Faculty Fellowship Program.

Unfortunately, due to a severe cut (25%) in our T/TT faculty lines, and the reduction of our experimental program to one professor, the Chair has arranged for two PhD students to conduct their PhD research in laboratories out of state. One student is working at Colgate University in Quantum Optics, the other in the same field at the AFRL/RITA (Quantum Computing Group). While this is far from satisfactory, this is the only way these PhD candidates could be retained at FAU. We have lost numerous students to other universities for this reason.

Advising Procedures

When new graduate students enter our program they are sent to the graduate advisor of the department. The advisor informs them about what courses are required and how many electives they have to take, helps them to figure out what courses to take and when to take them. We take into account their individual level of preparation. Some of the students in our PHD program come to us just after finishing their BS, while others may have a MS already. In the latter case we ask them to take required courses only if they have not had an equivalent graduate course at their previous institution. The graduate advisor also helps the students with enrolling in their courses. This process has now become quite bureaucratic and thus new students need a lot of help with this.

There is one graduate advisor for all of our graduate students. In addition, we have an advisor specifically for the students in the PSM in Medical Physics program, and in the MST in physics degree program, advising is handled by interview with the MST director. Students are expected to find a research adviser in their chosen area of research as early as possible, usually after their first year. Until then the graduate advisor of the department acts as their advisor. In April our students together with their advisers and fill in an electronic annual progress report. This form has been implemented since our last review. It addresses what courses they have taken, as well as their publications and presentations. This form also contains feedback comments of their advisers about accomplishments, goals and concerns. This helps us track their progress. This form is also used formally in our assessment of the graduate programs in physics.

Each year the students are expected to give at least one presentation about their research in front of their thesis committee. This is useful in identifying problems early. Most of the advising on actual research is done informally when students meet with their advisers.

A staff member supports the graduate adviser and graduate students to navigate the pertinent bureaucracy for tuition waivers, removing holds, etc., and for new students to complete their initial paperwork, attend required trainings, etc. As mentioned, new graduate students obtain an initial plan of study listing a possible pathway of courses to complete the course requirements of their graduate degree. Every semester

students update this plan in coordination with their advisor, fill out any waiver forms, and forms allowing them to conserve dissertation credits once they have reached their 80 credit threshold.

Licensure Rates

There is no licensing program for physics.

Placement Rates/Employment Profile

The Department of Physics does not collect or receive placement data for graduate students in physics, except for the PSM in Medical Physics program (shown in PMSMP Table below).

Graduation Rates

Master's degrees:

	Year Degree Granted													All
	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	
Single major	2	3	0	0	1	1	1	1	1	8	7	7	4	36
Double major	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2.0	3.0	0	0	1.0	1.0	1.0	1.0	1.0	8.0	7.0	7.0	4.0	36.0

(A degree awarded with a single major contributes 1 degree, and a double major contributes ½ degree.)

Professional Master of Science in Medical Physics (PMSMP)

Statistics 2010-2014

	2010	**2011**	**2012**	**2013**	**2014**
Applicants	21	23	10	6	12
Offered Admissions	9	13	2	5	9
Matriculated	9	7	5	1	5
Graduated		1	2	3	6
Graduates in Residencies					
Graduates in Industry			1		
Graduates in Clinical Positions			1	1	4
Graduates in Advanced Degree Programs		1	1	2	1
Graduates in Academic Positions					

Doctoral degrees:

				Year Degree Granted										All
	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	
Total	0	7	3	5	5	2	0	2	3	0	6	2	2	39

The physics department has averaged 3 doctoral degrees granted per year over the last 13 years, which indicates the graduate program is currently at a sustainable level within FL-state PhD graduation requirements, though minimally.

Student Recruitment

Recruitment at the graduate level relies on the world-class research done in the department, which attracts some of the best graduate students, as well as relying on "word-of-mouth" spread by current graduate students to students whom they know at their former undergraduate institutions. Our Department of Physics website is also a useful recruiting tool. Another major tool in recruitment is made possible through funding from FAU's Graduate College. While we have very limited leeway in the amount of financial support we can offer, we offer Presidential or Provost Fellowships to particularly strong applicants.

While "word-of-mouth" recruiting has proven to be quite effective for foreign national students, we still have difficulty attracting similar high a quality US students into our program.

At times, local high school teachers actively seek out admission into our doctoral program or M.S.T. program in order to further their teaching career. When possible, we as a department actively support such teachers and believe this is an important way we can serve the educational system in our local community.

Recruitment for the Professional Science Master in Medical Physics program has been conducted primarily through internet. Our program is advertised in the Department of Physics' web site:

1. (http://physics.fau.edu/programs/MSMP_CatalogDescription.php).

Our second web presence is a link on the professional science masters degree website

2. (http://www.sciencemasters.com)
   http://www.sciencemasters.com/portals/0/Speaker/PSM_Implemented_Programs_by_State.pdf
3. http://www.npsma.org/academic-members

The Program Director is a member of the Society of Directors of Academic Medical Physics Programs (SDAMPP). PSMMP is included in the list of graduate programs of the website

1. (http://www.sdampp.org/progprams.asp).

FAU is a member of the National Professional Science Masters Association (NPSMA); Our program is listed in

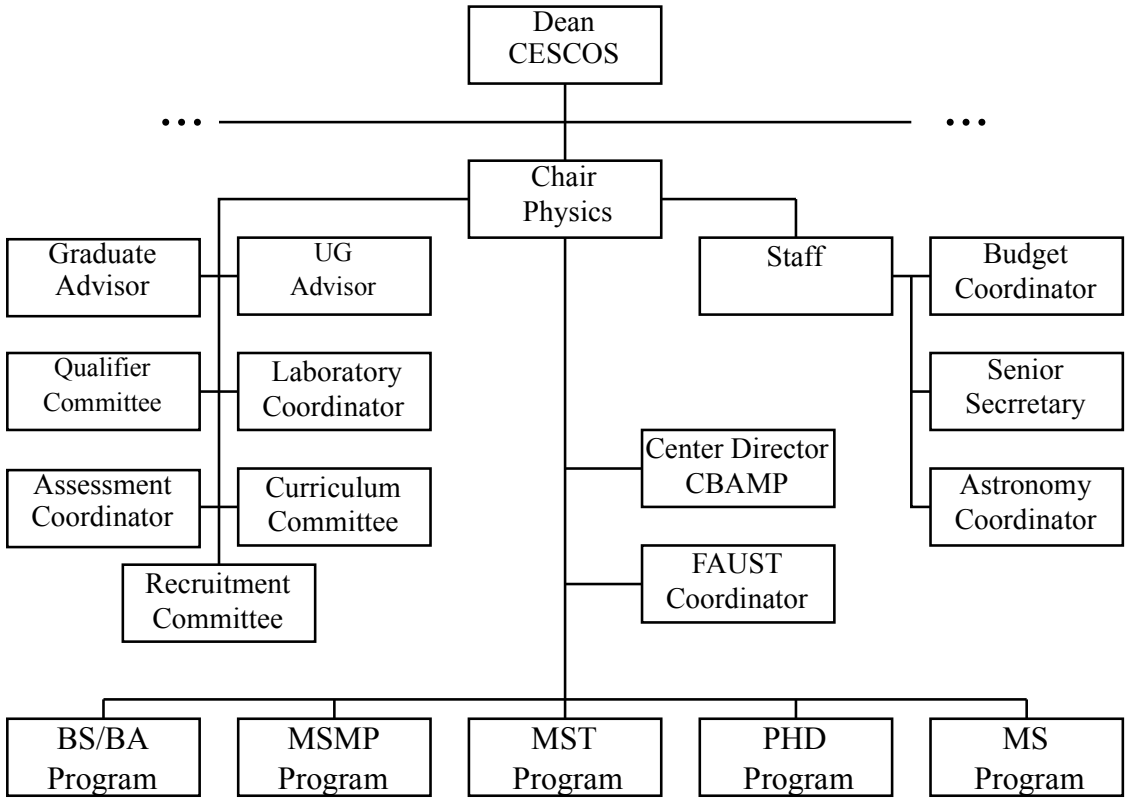
2. http://www.npsma.org/academic-members

Additionally, the Department of Physics has provided the Office of Students Services of the Charles E. Schmidt College of Science and the Graduate College with brochures of the program for distribution at recruitment drives. We also have sent program brochures to other Physics Departments by e-mail.

3. Faculty

Administrative Structure of the Physics Department

A department chair oversees the operation of the Department of Physics. The Chair is elected by the faculty and serves at the discretion of the Dean. The chair is responsible for the department's degree programs. The organizational chart of the Department of Physics is shown below. The Chair is greatly assisted by his three staff members as well as the faculty representative(s) assigned by the chair to seven essential committees (positions). Given the relatively small size of our department with respect to the research/service and instructional load, the Chair has decided to keep assignments in these various committees stable over at least 5 year periods, unless changes are required.



There are four primary administrative responsibilities of the Chair:

1. *Assignments:* The Chair makes all faculty assignments in consultation with the Dean.
2. *Scheduling:* The Chair schedules all classes with the administrative help of the Senior Secretary.
3. *Evaluations:* The Chair evaluates all faculty and staff annually and provides feedback. The Faculty evaluation form is shown in Appendix 3. The Chair uses faculty input from the Annual evaluations to report on the Departmental Dashboard Indicators.
4. *Budget:* The Chair manages the budget of the program.

While there are many other duties of the Chair, these are the principle duties. Much of the operational administration of the department falls on the shoulders of our nine dedicated faculty assigned to seven principle committees/positions, as well as our three staff members. In particular, the three staff are responsible for the following:

1. *Budget Coordinator:* Our budget coordinator is responsible for adhering to state, university, college and departmental regulations in the administration of the fiscal transactions of the

department. In particular the budget coordinator manages (1) the OPS budget for salaries, (2) Division of Research grant proposal and contract management, (3) the departmental expense budget, (4) travel reporting and reimbursements, (5) startup and buyout-overload account management, and (6) foundation accounts. In addition, our budget coordinator is also the coordinator of our UG program with the purpose of providing a richer research environment for our UG students as well as building their esprit de corps. Additionally our budget coordinator also manages one of our largest outreach programs – the Annual Physics Carnival and Pumpkin Drop. There is more …

2. *Astronomy Coordinator:* Our astronomy coordinator manages our largest and most successful instructional and outreach program in the department. Our observatory reached literally thousands of people each year ranging from members of the community, distinguished guests of the university, FAU students, K-12 public school students. Our observatory coordinator is also active in numerous other related activities outlined in Section E: Service and Community Engagements. The coordinator has also designed and teaches an upper-level Solar System Astronomy course for our UG majors. In addition, the astronomy coordinator also arranges for internal (faculty and graduate student) and external speakers to present current research to our UG students. The astronomy coordinator manages the operations, maintanience and renovations of the observatory. There is more …
3. *Senior Administrative Assistant:* Our senior administrative assistant is the front line of all our departments operations. The administrative assistant is responsible for all time and effort reporting, helps with travel authorization requests (TAR), supports the graduate recruiting effort and communication with the students and the graduate and undergraduate colleges colleges. Administrative support is also given to CBAMP and the newly-accredited Medical Physics Program. This position manages a smoothly-functioning departmental office and a welcoming environment for students, faculty, visitors and fellow staff. In addition, the Chair utilizes the administrative assistant in the scheduling of classes each semester, and as an interface between the Chair and the large general education class instructors, as well as the university offices. There is not a single activity or bureaucratic responsibility that does not have the administrative assistant's involvement. There is more …

Finally and as already mentioned the bulk of the operational administration of the academic programs of the department falls on the shoulders of our dedicated faculty assigned to the following seven principle committees/positions:

1. *Graduate Advisor:* The department has a single graduate advisor (GA). The GA is responsible for advising, tracking, all graduate-student activities. This position requires liasson duties between the department Chair, its faculty and staff, the College's Associate Dean for Graduate Studies and the University's Graduate College. The graduate advisor is the principle advisor for all graduate students until they pass their PhD qualifying exams or are assigned an advisor. The GA is is also on the Curriculum committee and teaches one or more of the core courses of our graduate students.
2. *Undergraduate Advisor:* The department has a single advisor within the department for our undergraduate students. Our Undergraduate Advisor (UGA) coordinates closely with the Colleges' Physics Advisor in the College Student Services Office. The UG advisor is also on the Curriculum committee and teaches one or more of the core courses of our undergraduate students.
3. *Qualifier Committee:* The Qualifier Committee (QC) is chaired by the Department Chair. Its task is the decide when our PhD students achieve candidacy and to recommend continuation in our program. Members composition of the committee are the faculty that last taught one or more of our four graduate courses covered on our written qualifying exam. The members of this committee write and score the qualifying exam each year following established guidelines.
4. *Instructional Laboratory Coordinator:* Our Laboratory Coordinator is a Senior Instructor. This coordinator is the instructor of record for over 60 sections of general physics labs. This coordinator also teaches the Physical Electronics Laboratory for our BS majors. The laboratory

coordinator assists the Chair in making all 28 TA assignments. This coordinator maintains the laboratories, writes the laboratory manuals and trains the new TA's. It is the unanimous opinion of the faculty that no single person should be responsible for this amount of work.

5. *Assessment Coordinator:* Assists the Chair in assessing all degree programs in the department and to help formulate more and more relevant assessment goals.
6. *Curriculum Committee:* This committee recommends curriculum changes to the faculty and Chair. The committee is discusses all proposed changes to the curriculum to the department of physics before it is sent to the UG or Graduate Curriculum committees.
7. *Graduate Recruitment Committee:* We have three faculty serving to recommend graduate students to our faculty for admission into one of our programs. The new recruitment chair has effectively engaged more of the department into the final decisions. This is a positive development for our selection process.

Faculty Profile

Faculty diversity in the physics department can be read from the following tables.

Instructional Faculty (Tenured, tenure-earning, & non-tenure-earning)		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
American Indian/Alaskan Native	Male					1
	Total					1
Asian or Pacific Islander						
	Female	2	2	1	7	28
	Male	2	2	1	15	78
	Total	4	4	3	23	107
Black (Not of Hispanic Origin)						
	Female	0	0	0	1	30
	Male	0	0	0	3	18
	Total	0	0	0	4	49
Hispanic						
	Female	1	1	0	3	34
	Male	2	2	1	4	23
	Total	3	3	1	8	58
White (Not of Hispanic Origin)						
	Female	1	1	1	23	276

Instructional Faculty (Tenured, tenure-earning, & non-tenure-earning)		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
	Male	10	11	9	86	382
	Total	11	12	10	109	661
Total						
	Female	4	3	2	34	368
	Male	14	15	11	108	502
	Total	18	18	13	144	876

* **B 2 Instructional Faculty and Adjuncts By Gender and Ethnicity – under Instruction on DDI data**

Faculty Teaching Load

In the 2012-2013 academic year, the average teaching load of a full-time faculty member in the physics department was approximately 17 credit hours for the academic year. (We use credit-hours rather than courses to take into account the fact that the department offers several 4-credit courses.) Not included in this calculation are directed independent studies (which the department encourages as part of the QEP), advanced research, and thesis and dissertation credits. Several faculty spend a great deal of instructional time in these "uncounted" classes.

Officially, the goal is two courses per semester for each tenure-track faculty member and four courses per semester for each non-tenure-track faculty member, but there are reductions in some cases. The chair, associate chair, and graduate director are normally assigned one course per term, as are first-year tenure-track faculty. The faculty members in physics with significant federally-funded research grants are frequently given a one-course reduction in the fall or spring semester. Coordinators for large lower-division courses are given a one-course reduction each semester, as are our faculty members that serve in substantial service positions (Chair of P&T committee, President of the Faculty Senate, etc.). Due to substantial reductions in our faculty numbers and increasing student enrollment, these guidelines cannot always be followed. In particular a single instructor of record handles our teaching laboratories. This faculty member coordinates the training of TA's, the maintenance of the instructional laboratories, and manages 20 GTAs. That all of our instructional lab sections (PHY 2048L and PHY 2049L) are taught by one senior instructor, and there is no younger faculty being mentored in this capacity is a grave concern for the department. These laboratories are a major facet of science education for the College and University.

The following table (annualized FTE produced per instructional person-year, from IEA) provides additional information:

	Physics	College Total	University Total

	2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Undergraduate	14.2	14.2	16.2	19.4	19.1
Graduate	1.0	0.9	0.8	1.1	2.8
Total	15.2	15.1	17.0	20.5	21.9

*Chart D1 Annualized FTE Produced Per Instructional Person-Year under Efficiency Data in DDI

The rise in annualized FTE produced by the physics department over these three years corresponds to the rapid rise in FAU enrollments over that period at the same time that yearly budget cuts produced a decline in the number of tenure-track faculty in the department. This is another indication of the increasing strain under which the physics faculty have been working in the last few years.

Summary of Faculty Research Productivity

Faculty research productivity is summarized in section D below, under the review of part II of the Department Dashboard Indicators.

Strategic Planning for Hires

New and replacement faculty lines are decided by the provost, following requests made by the department thru the dean. The provost also determines the rank of the hires based in part on the department and dean's input. We currently have the following hiring strategy:

1. We are proposing the hire of an experimental Biophotonics group of 4 faculty and two technicians at the Jupiter FAU campus as a joint collaborative effort between Science and Engineering.
2. To increase sponsored research from the current 33% of the T/TT faculty to over 50%. This is substantially higher than the College and University goals.
3. To establish a consistent Postdoctoral Research presence in our program. We currently have one Postdoctoral Researcher and we expect to hire a second in the Spring 2015.
4. Continue to build upon our newly accredited Medical Physics program by making two faculty hires. We are currently searching for a Medical Imaging faculty member at the tenure track Assistant Professor level.
5. We propose to replace faculty that retire by building upon our department's core strength in general relativity.
6. In order to handle the 60 sections of lower level physics courses, we propose to hire an Assistant Instructor as an Assistant Laboratory Coordinator.

Abbreviated Faculty CV's

Faculty CV's are included in Appendix 4.

D. Research

Research thrusts within the Department of Physics is primarily concentrated in two areas (A) General Relativity and (B) Biomedical and Materials Physics. Our research in these two areas has become quite interdisciplinary reaching out to (A) Engineering and Computer Science and Pure and Computational Mathematics, as well as (B) Medicine; respectively.

We have three active federal grants in the Department of Physics all from within our FAUST group:

1) One of our faculty members' research was recognized by a $785K DoD grant as PI on an effort involving a discrete formulation of Hamilton's Ricci Flow equations. This effort involved FAU Physics with two Co-PI's; Field Medalist S-T Yau of the Mathematics Department at Harvard University, and David X. Gu a world leader in applied Ricci flow from SUNYSB. The PI was invited to Harvard University for two years as a Visiting Scholar of Mathematics. This effort has led to a follow on grant beginning in 2015. The PI involved an FAU mathematics professor as a co-PI on this follow-up effort. This research has led to the first recognized discrete formulation of Ricci flow called Simplicial Ricci Flow, and is applicable to arbitrary dimensions. Simplicial Ricci Flow is being applied in the follow-up grant to complex networks, cluster state quantum computing as well as potential medical applications.
2) Jon Engle, a tenure track Assistant Professor in the Physics Department was awarded a $120K NSF grant to solve open issues in the dynamics of loop quantum gravity and in the application of loop quantum gravity to early universe cosmology. This research has led to (1.) an important correction in the path integral dynamics used in loop quantum gravity up until now, ensuring the correct classical limit, (2.) an application of this corrected dynamics to predict expected quantum correlations of the gravitational field in vacuum, as well as (3.) the most complete derivation thus far of the LQC quantum cosmological model from full loop quantum gravity. He has applied for an NSF renewal grant which would support a continuation of these lines of research.
3) Wolfgang Tichy, Professor of Physics, was awarded an NSF grant to simulate binary neutron star mergers.

A. The FAU Spacetime Physics Group (FAUST):

In 2003 the Department of Physics established this group as a primary thrust for the department. Over the past 11 years this group has grown into one of the largest general relativity and quantum gravity groups in the nation. Additionally, we have hired a new tenure track Assistant Professor Muxin Han to help strengthen our Quantum Gravity research effort. With this hire, and with natural collaborations we have established with the Mathematics Department and with the College of Engineering and Computer Science, we will request to form a FAU Spacetime Physcis (FAUST) Center. One of our Associate Professor was recruited by NSF and left FAU to become the NSF Program Manager for Gravitational Physics.

B. *Center for Biomedical and Materials Physics (CBAMP):*

In 1989 the Department of Physics established the Alloy Research Center (ARC) as a Type III center. Over the years, ARC has evolved to the Center for Biomedical and Materials Physics (CBAMP) a university-wide center, with collaborative Faculty from two FAU Colleges. CBAMP includes Medical Physicists/Research Affiliate Professors in the Professional Science Master of Medical Physics program. Faculty in the Center has considerable collaborative efforts with Ocean Engineering faculty in joint research, publications, and submission of proposals. Its mission provides a focus for communications and forging collaborations to facilitate studies in Biological Physics, Biomedical Physics, and Materials Physics. The Center's vision is aligned well with the FAU Mission to provide excellence in both disciplinary and interdisciplinary science education for our students, and to apply the power of inquiry and discovery to fundamental problems of scientific importance.

To further develop an internationally recognized research and instructional program and to meet the needs of the region, the nation and the global community CBAMP has established MOU's and solid working relationships with the following Institutes and Centers:

1. Center for Nanophase Materials Sciences (CNMS), of the ORNL
2. Neutron Sciences (High Flux Isotope Reactor), ORNL
3. Center for Computational Sciences, ORNL
4. Lynn Cancer Institute of the Boca Raton Regional Hospital
5. South Florida Radiation Oncology
6. 21st Century Oncology
7. Wellington Regional Medical Center

Review of Part II of the Department Dashboard Indicators

The following table (from IEA) summarizes physics department research person-years and FTE based on annual assignments.

					Physics			College Total	University Total
					2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Departmental Research	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years		3.6	2.9	1.9	20.0	92.7
			FTE		4.8	3.8	2.5	26.7	123.6
	Non-tenure-earning faculty	Instructors, Lecturers, Visiting Faculty	Person-Years					1.4	4.1
			FTE					1.8	5.5
	Other personnel paid on faculty pay plan	--	Person-Years		0.6	0.4	0.1	1.6	15.9
			FTE		0.8	0.6	0.1	2.1	21.2
	Total		Person-Years		4.2	3.3	2	22.9	112.8
			FTE		5.6	4.4	2.6	30.6	150.4
Sponsored Research	Tenured & tenure-earning faculty	Professor, Assoc Professor, Asst Professor	Person-Years		1.2	1	.6	6.4	24.9
			FTE		1.6	1.3	.7	8.5	33.2
	Non-tenure-	Instructors,	Person-					0.3	3.7

					Physics			College Total	University Total
					2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
	earning faculty	Lecturers, Visiting Faculty	Years						
			FTE					0.4	4.9
	Other personnel paid on faculty pay plan	--	Person-Years			0.7	0.9	7.3	38.2
			FTE			0.9	1.2	9.8	50.9
	Total		Person-Years		1.2	1.6	1.5	14.0	66.8
			FTE		1.6	2.2	1.9	18.7	89.0

*Chart B1 Faculty Person Years and FTE Devoted to Research under II. Research, Creative & Scholarly Activities in DDI Data

The following tables (from IEA) list various aspects of research in the physics department over the period 2010-2013, both in absolute numbers and in numbers per faculty member in the department, and compares these with the college and the university, as reported in the Department Dashboard Indicators.

		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
1. Books (including monographs & compositions)	#	5	5	7	22	146
2. Other peer-reviewed publications	#	26	22	21	229	1,161
3. All other publications	#	16	9	16	31	501
4. Presentations at professional meetings or conferences	#	39	20	27	308	1,435
5. Productions/Performances/Exhibitions	#	6	7	34	36	377
6. Grant Proposals Submitted	#	10	12	5	109	385
Sponsored Research & Program Expenditures						
7. Organized Research	#	$220,845	$299,475	$421,621	$8,625,887	$15,603,749
8. Sponsored Instruction	#	$65,555	$64,628	$28,515	$1,242,409	$6,138,254

		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
9. Other Sponsored Activities	#	$41,817	$53,325	$0	$620,037	$2,565,166

*Chart C1-9 Research/Scholarly Productivity under II. Research, Creative & Scholarly Activities in DDI

		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
1. Books (including monographs & compositions) per faculty member		0.4	0.4	0.8	0.2	0.2
2. Other peer-review publications per faculty member		2	1.8	2.3	2.1	1.8
3. All other publications per faculty member		1.2	0.8	1.8	0.3	0.8
4. Presentations at professional meetings or conferences per faculty member		3	1.7	3	2.9	2.3
5. Productions/Performances/Exhibitions per faculty member		0.5	0.6	3.8	0.3	0.6
6. Grant proposals submitted per faculty member		0.8	1	0.6	0	0
Sponsored Research & Program Expenditures						
7. Organized research expenditures per faculty member		$16,988	$24,956	$46,847	$80,616	$24,534
8. Sponsored instruction expenditures per faculty member		$5,043	$5,386	$3,168	$11,611	$9,651
9. Other sponsored activity expenditures per faculty member		$3,217	$4,444	$0	$5,795	$4,033

*Chart D1-9 Efficiency Data under II. Research, Creative & Scholarly Activities from DDI

From these tables, one sees that the research productivity of the physics department has remained roughly constant. This is particularly impressive given the 25% reduction in our T/TT ranks within the department.

Interdisciplinary Efforts

Physics is the purest of the sciences, is involved in the study of the dynamical laws of nature, and is

inherently interdisciplinary. The Department of Physics routinely interacts with other departments and colleges. Interdisciplinary efforts have concentrated around our DoD funded research, our medical physics program and our general relativity efforts in FAUST. They are summarized as follows:

1. Chris Beetle's graduate student preformed his dissertation research experiments on two-photon imaging of the brain at Max Planck Florida. He and his student have close research collaborations with William Rhoads in Engineering.
2. Warner Miller was invited by Field Medalist S-T Yau to work with him for two years at Harvard University as a Visiting Scholar. This work established the first discrete formulation of Hamilton's Ricci Flow applicable to arbitrary dimensions. This work has been presented in numerous invited talks at mathematics conferences, seminars and colloquia.
3. Korey Sorge and his PhD students helped establish close connections between faculty in the Department of Physics and faculty in departments within the College of Engineering, particularly the Department of Mechanical and Ocean Engineering. Two of his PhD students that received degrees in physics while doing research in the research laboratories of faculty in Ocean Engineering. In each case, these students "co-advised" by faculty of both Departments with the Primary Advisor in the Department of Physics.
4. There are also close connections to departments within the CESCoS. Faculty in the Department of Physics routinely serves on Masters/PhD committees for students in other departments. In particular, there are close ties with the research group of Stephen Kajiura in the Department of Biological Sciences and Korey Sorge's magnetometry laboratory. Dr Kajiura's group looks at electroreception and magnetoreception of sharks.
5. Finally, these connections are not limited to graduate work. With FAU's focus on undergraduate research, faculty in the Department of Physics have research projects arranged that will incorporate undergraduate students from the College of Engineering.
6. Warner Miller is a faculty member in the Department of Mathematics Center for Cryptology and Information Security (CCIS). Collaborations within this center have led to a new DoD grant PI'ed by Miller and the Director of the Center, R. Steinwandt.
7. Luc Wille has ongoing collaborations in the area of ecological modeling with colleagues at the South-Florida Water Management District.
8. L. Wille (with a graduate student) collaborates with colleagues in the Department of Anthropology on the fractal analysis of fragments in archeological deposits.

Establishment of Goals for Research

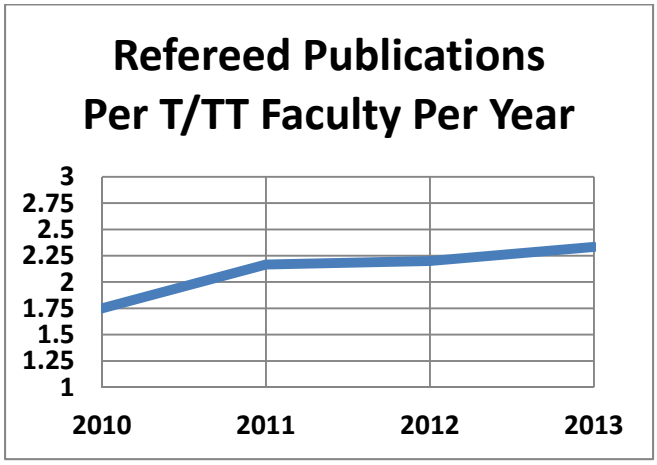
The mission of the Department of Physics at Florida Atlantic University is to foster a deeper and more holistic understanding of the fundamental interactions in nature, and apply this knowledge to both pure and applied aspects of the discipline. We strive to provide first-rate undergraduate and graduate education in physics to our students and to increase scientific knowledge in the community at large. We seek to advance the frontiers of scientific knowledge by engaging in innovative research and tackling fundamental problems in physics. We work to bridge research, education, and applications of the physics to serve the needs of the local community and the larger global society. With this mission in mind, the department sets the following research goals.

1. Establish an experimental Biophotonics group of 4 faculty and two technicians at he Jupiter FAU campus as a joint collaborative effort between Science and Engineering.
2. To increase sponsored research from the current 33% of the T/TT faculty to over 50%. This is substantially higher than the College and University goals.
3. To establish a consistent Postdoctoral Research presence in our program. We currently have one Postdoctoral Researcher and we expect to hire a second in the Spring 2015.

4. Continue to build upon our newly accredited Medical Physics program by making two faculty hires. We are currently searching for a Medical Imaging faculty member at the tenure track Assistant Professor level.
5. Involve more UG student is research through Directed Independent Study (DIS) projects and our Physics Honors Program.

Assessment and Evaluation of Research Goals

In the Department of Physics research is emphasized and assessed each year within each faculty member's annual review (Appendix 3). In addition to publications, books, invited talks the department also evaluates grant activity. In the annual evaluation externally funded research will be awarded a rank of Excellent, proposals(s) submitted will be assigned a Above Satisfactory, no proposals submitted given needs Unsatisfactory. The department has 9 T/TT faculty members. Across the university approximately 5% of the faculty has secured federal funding. In the Department of Physics, 33% of our faculty are federally funded for basic research, we fully expect that over the next few years that this percentage to exceed 50%. Last year (FY13-14) Sponsored Research in the Department of Physics accounted for a little over a third (#$%) of the Department's total operating budget. Additionally, each of our un-funded faculty members are research active and each of them consistently publish papers in refereed journals, and most are supervising PhD two or more PhD and MS students. We believe this is a result of our excellent hires over the past decade.



The Department of Physics' Research efforts as far as federally funded research grants and refereed publications exceed the College and university goals. These grants were from some of the most highly competitive federal organizations, and within NSF two of our grants were in the extremely competitive area of Gravitational Physics. We expect that these two indicators, funded grants per faculty and number of refereed publications per faculty, will steadily increase in the next two years to 50% grants per T/TT faculty member to over 3 refereed publications per T/TT faculty member.

E. Service and Community Engagement

Review of Part II of the Department Dashboard Indicators

The following table (from IEA) summarizes physics service data, as reported in the Department Dashboard Indicators.

		Physics	College Total	University Total
		2012-2013	2012-2013	2012-2013
1. Faculty memberships on department, college or university committees	#	40	273	2,348
2. Faculty memberships on community or professional committees	#	4	69	972
3. Faculty serving as editors or referees for professional publications	#	13	96	611

*Chart B1-3 Service Productivity under III. Service in DDI

These three numbers are consistent with the College when factoring in the relative size of the Department of Physics (~10%) except for the number of faculty memberships on departmental, college or university committees where the physics number is roughly 50% larger per faculty than the college.

Community Engagement

In addition to the service to the physics profession summarized in the table above, the Department of Physics engages the local South Florida education community by offering a number of outreach programs designed to stimulate interest in physics, and includes the following activities:

1. The Observatory's Outreach

The Astronomical Observatory provides observational credit sessions for the Introduction to Astronomy and the Solar System Astronomy students as well as Outreach effort to the Palm Beach and Broward counties. The credit sessions for the Introduction class generally involve night sessions and a solar session with an H-alpha filter. The Solar System Astronomy students have a semester long assignment to study the planets available and/or other various components of the planetary formation (nebula, comets, asteroids …). ***The number of student that come to the Observatory are about 100-150 each for fall and spring, and around 25 - 50 for the summer session.***

The Observatory's Outreach efforts try to connect the public with astronomy in many ways. We "celebrate" outer planet Oppositions to the Sun, two to three times a year. At the time of an outer planet's Opposition to the Sun, the Earth is at its closest position to that planet for that orbital pass, hence the views the planet are the best they can be for the year. During the night, we include a presentation that provides updated information about the planet and its moon, and any particular missions to explore it, while people can look at it through the telescope. We are very pleased to say that they are well attended and invoke a great deal of discussion and questions among the guests. We are often announced in the

local newspapers for these sessions. We also provide special events, such as the "Vesta Fiesta", or "Transits of the Sun". In addition to that we are often a destination for local schools or summer camps to come to as a field trip to learn about the Sun. Finally we offer twice a month public viewing sessions that are basically a fun night at the telescope, with occasional presentations as the interest in some appropriate topic occurs. ***For our Outreach events, we get around 500 - 600 guests a year, though we must admit that we often get repeat visitors.***

Our outreach work continues outside the Observatory as well. We have provided various astronomical talks to local groups such as the Astronomical Society of the Palm Beaches about accretion disks, the South Florida Science Museum and Aquarium about the benefits of Lunar Colonization, a talk about new Solar System Formation theories to the Science and Technology Group at Palm Isles in Boynton Beach, another talk to Boca Raton Public Library based on a book called "Packing for Mars", and even gave an "Astronomy class" to the "Hogwarts School of Witchcraft and Wizardry" at the Lantana Road Branch Public Library about the wonders of the summer skies. We have co-founded and host the South Florida Chapter of the International Dark Sky Association to help raise the awareness of the problems of light pollution in the most heavily light polluted counties in the State of Florida. Artificial outdoor lighting that glares outwards causing light trespass and/or points upwards to space is an exponentially increasing problem to our wallets, to the environment, to our own health and to appreciating the majesty of the night sky. Our efforts here involve giving talks about the issue to various nature centers and libraries across the county, such as Gumbo Limbo Nature Center in Boca Raton, Green Cay Nature Center in Boynton Beach, almost every public library the county offers, including various departments inside FAU as well. We have also collaborated with Palm Beach County's Dept. of Environmental Resources Management, their Parks and Recreations Dept., Gumbo Limbo, and Okeeheelee Nature Center in West Palm Beach to create Palm Beach County's Dark Sky Festival in late winter. ***Our third and biggest event yet will be held in Feb. 2015 with an expected attendance to reach over 2,000 visitors.***

With regard to the light pollution problem, we have even helped raise awareness internationally by helping to provide better translations between English and Korean for the Feelux Lighting Museum in Seoul, South Korea, for their own Light Pollution Photography and Videography Contest. This year was their contest's tenth anniversary and they wanted it to go international. My assistant, Han Soul, is from South Korea and she wanted to help them with their effort. So we worked together to translate poster information that we had to Korean and translated their Korean webpages into English for a broader outreach. Their website at http://www.lighting-museum.com/light_pollution/en/index.html still records our translations and efforts to help them better connect to the world.

2. Annual Physics Carnival and Pumpkin Drop

Since 2007, the Physics Department hosts its Annual Physics Carnival and Pumpkin Drop every Halloween. This is our major community outreach effort that exposes middle school children to basic physics principles at an early age. ***Approximately 300 children from the Henderson and SD Spady Middle Schools attend each year.*** They are treated to an educational and fun day of science that involves an extensive hands-on physics demonstration table, making ice cream with liquid nitrogen, playing physics related games, observing drones in flight, and a dunk tank. The day concludes with the main event: the Pumpkin Drop. One of our Physics Professors delivers a mini-lecture to the students to teach

them about gravity, acceleration, and terminal velocity. Physics Professors then drop real pumpkins off the roof of our 4-story building in order to demonstrate these concepts.

3. Traveling Physics Group

In the future we would like to implement another public outreach program: a traveling physics group. This traveling group would bring hands-on physics demonstrations to the local middle schools and high schools. The group would be comprised of one Faculty member, one Staff member and several Graduate and Undergraduate students. By continually exposing children to physics and making physics accessible to them, we hope to pique their interests in the field. Ideally, we anticipate that sparking their interests in physics would lead to a higher number of physics majors once they reach college.

In addition to these departmental outreach activities, we also participate actively in College events:

Frontiers in Science

Every Spring semester the Charles E. Schmidt College of Science holds a lecture series that is open not only University-wide but to the general public. Though scientific in nature, the lectures are geared more toward the layperson's level. Every department in the Charles E. Schmidt College of Science is represented and this particularly allows the Physics Department to highlight some groundbreaking research in the field. The Physics Department has participated in this lecture series every term since its inception with 1 to 2 speakers per program.

Science Olympiad

Every Spring, the Charles E. Schmidt College of Science hosts the Southeast FL regional qualifier for the national Science Olympiad competition. Science Olympiad is a national science and engineering competition that encourages teamwork through the format of an "academic track meet." The event consists of multiple events in: genetics, earth science, chemistry, anatomy, physics, geology, mechanical engineering and technology. Middle and high schools create competitive teams to win the events and eventually the competition. On the day of this event, there are as many as 600 students on campus that are exposed to science. Faculty and students in the Department of Physics play crucial roles in event organization, supervision and judging. In fact, it is Physics Department policy that all new Graduate Students serve as volunteers in their first Spring semester. It is such an enjoyable experience for our Graduate Students that they tend to volunteer in subsequent years.

Establishment of Goals for Service

The mission of the Department of Physics at Florida Atlantic University is to foster a deeper and more holistic understanding of the fundamental interactions in nature, and apply this knowledge to both pure and applied aspects of the discipline. We strive to provide first-rate undergraduate and graduate education in physics to our students and to increase scientific knowledge in the community at large. We seek to advance the frontiers of scientific knowledge by engaging in innovative research and tackling fundamental problems in physics. We work to bridge research, education, and applications of the physics to serve the needs of the local community and the larger global society. With this mission in mind, the department sets the following service goals.

- The Department of Physics strives to serve the profession, expecting its tenure-track faculty to participate on committees within the university and in the larger science community, and act as referees or editors for professional publications.

- The Department of Physics endeavors to serve the South Florida community and meet the needs of local schools, businesses and non-profit organizations. We expect its faculty to engage the community, participate in established programs, and initiate new projects as the need arises.

Assessment of Service Goals

The physics department clearly meets its service obligations to the university and the professional community through committee work as well as referee and editorial responsibilities, as evidenced by the DDI data. In particular, for such a small T/TT faculty we serve on some of the most important service positions in the university, (1) President of the Faculty Senate Elect (C. Beetle), (2) Chair of the College P&T committee and member of the University P&T committee (L. Wille), (3) Co-Chair of the High Performance Computing Committee (W. Tichy) and (4) Member of the University Academic Affairs Committee (W. Miller).

The physics department's astronomy-related outreach activities extend to thousands of people per year and reveal a strong and successful commitment to engaging the local community and students in order to inspire them to the role of science in society. Our annual pumpkin drop and physics carnival provides a fun setting for the education of hundreds of local middle and elementary-school students. The department expects to continue these educational interactions with students and teachers, and to build upon them to enhance the partnership with the local schools.

The physics department has been recently successful in forging partnerships with local businesses through our Professional Science Master in Medical Physics. To further develop an internationally recognized research and instructional program and to meet the needs of the region, the nation and the global community CBAMP has established MOU's and solid working relationships with the following Institutes and Centers:

1. Center for Nanophase Materials Sciences (CNMS), of the ORNL
2. Neutron Sciences (High Flux Isotope Reactor), ORNL
3. Center for Computational Sciences, ORNL
4. Lynn Cancer Institute of the Boca Raton Regional Hospital
5. South Florida Radiation Oncology
6. 21st Century Oncology
7. Wellington Regional Medical Center

The Department of Physics recognizes the importance of making connections with local business and industry, both as a responsibility of a university academic department and as an opportunity for research collaborations and funding.

F. Other Program Goals

Description of Other Program Goals

- The physics department strives to improve student performance in undergraduate physics courses in order to increase retention and graduation rates. Thus, the department is especially interested in increasing student success rates in courses in the IFP (listed above). Improving student performance in lower-division service courses can also increase retention and graduation rates for the undergraduate programs in physics by sending better-prepared students into upper-division courses taken by physics majors.

- The physics department seeks to strengthen its undergraduate degree programs and attract more undergraduate physics majors.

- Over the past few years we have provided a more cohesive environment for the interaction of our undergraduates wit themselves, the faculty, staff and graduate students. We have provided our UG majors with their own workspace (the UG Physics Burrow). We hold multiple meetings with our students, and provide integrated advising between our in-house physics advisor and the Colleges' Student Service physics advisor. Our enrollment has increased; however, we need new strategies in order to handle student retention.

G. Strengths and Opportunities

A primary strength of the Department of Physics is its dedicated and hard-working faculty and staff. Despite the heavy burden from repeated budget cuts coupled with massive enrollment growth over the last few years, the faculty and staff have maintained a positive attitude and friendly working environment. The faculty and staff spend many hours of their own time volunteering in community outreach activities, including the numerous Astronomy-related events and the Annual Pumpkin Drop and Physics Carnival. As one can see from the numerous pedagogical innovations implemented by various faculty members, they also genuinely care about students and their education. The faculty let their passion for science drive their research interests (as evidenced by the regular federal funding from NSF and the DoD by the department and the numerous well-attended seminars). Certainly the future of the physics department will be built on its current faculty, which must be its strength.

UG Program:

The number of Physics Undergraduate majors has been relatively low for at least the last 10 years. During this decade, if we were able to identify 8 Physics majors in any given year, and interacted with any of them on a regular basis, we considered ourselves fortunate. Only in recent years has our number begun to grow steadily. We have turned an unparalleled cornerstone in retaining our students. We have regular contact with many of them. With our limited budgets we actively began an outreach effort with the intention of attaining Undergraduate participation through various academic and non-academic activities. We gather our Undergraduate Students once a semester on an informal basis just so they can meet the Physics Chair, their Undergraduate Advisor, the Staff, and each other so that they feel that a support group is available to them. This makes a huge difference so that they do not feel isolated from the Department.

Most importantly, we kick-started our QEP efforts by pairing each UG's research interest with a corresponding faculty member. With this basic foundation laid, we intend to enhance our student's utilization of our honor's program, increase their participation in research, and assess this impact on UG physics major retention. We believe this active engagement (and pizza at our biannual meetings!) will attract new students to our program.

PMSMP Program:

The Professional Master of Science in Medical Physics is a distinctive program that offers opportunities for learning medical physics with a primary strength in Radiation Therapy Physics. The program's uniqueness lies in the partnerships between FAU and four major Hospitals/Cancer Centers in the area. Well-recognized medical physicists in the field of radiation therapy who are appointed as Adjunct/Research Affiliate Professors in the Physics Department provide the students with the opportunity of clinical training and research on one-to-one basis. The commitment of these medical physicists has a great influence on the students' accomplishments. A number of the students have already published and/or presented papers at the ASTRO and AAPM meetings before graduation. Our young program has produced several journal papers, presentations and papers at AAPM and ASTRO meetings. The partner hospitals make sure to have the students as participants in every meeting they organize.

Another strong component of the program is the high percentage of PSMMP students who are also PhD in Physics candidates. That raises the bar and motivates the students.

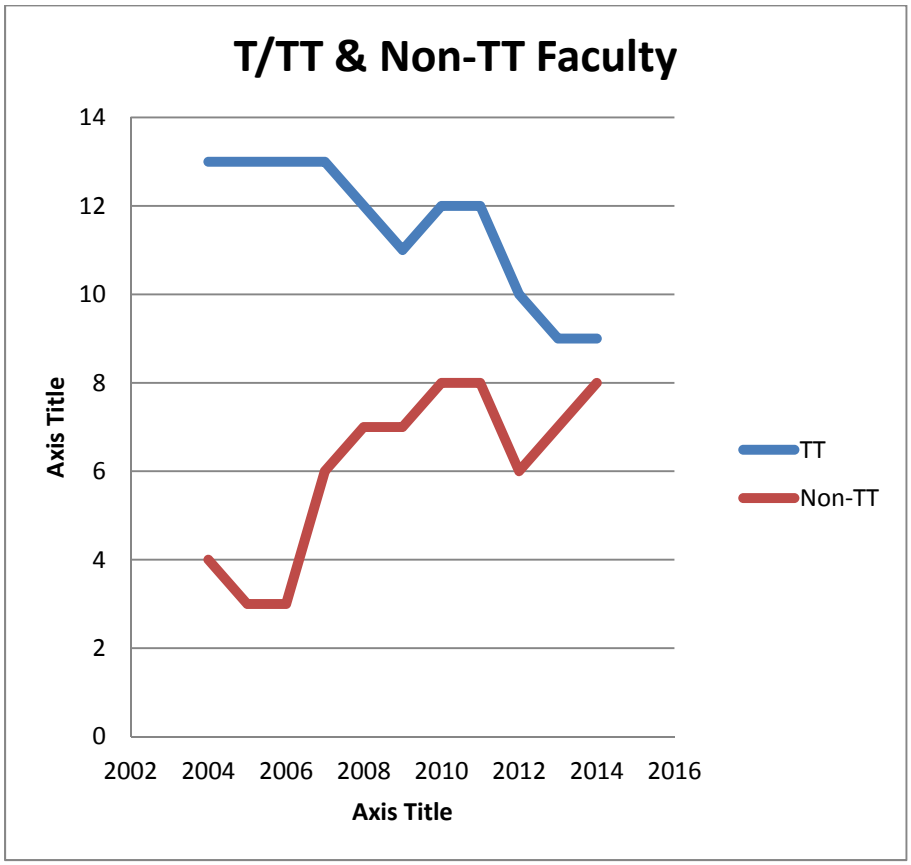
Support of the program from the community is extended to the medical field related companies. They have donated equipment and software, including treatment-planning system for the medical physics

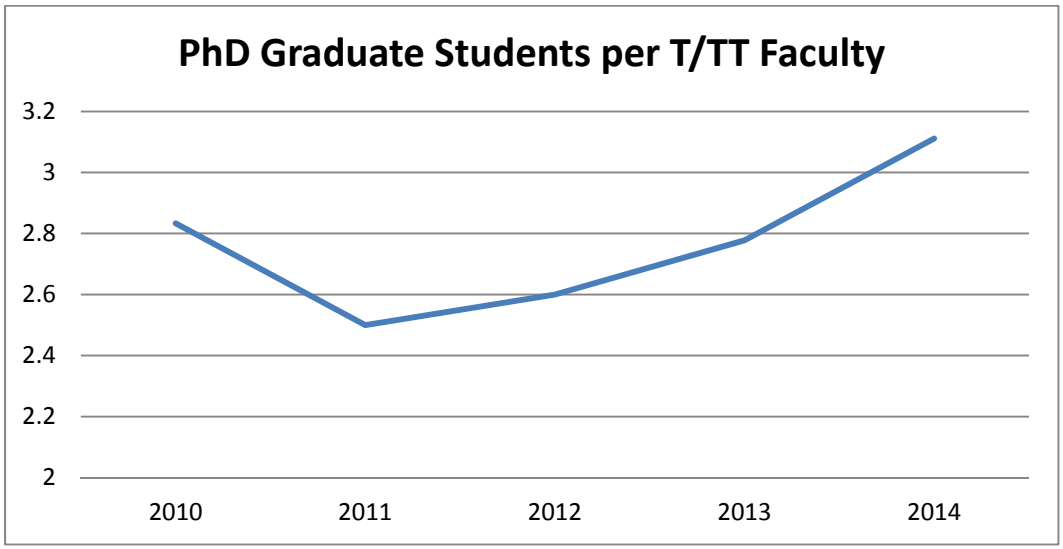
laboratory that is housed in the Department of Physics.

Interdisciplinary education offered by three Colleges at FAU such as the Charles E. Schmidt College of Science with participation of Faculty from three departments (Physics, Biology, Math), the Charles E. Schmidt College of Medicine, and the College of Engineering is another strength of the program. PSMMP students take their required and/or elective courses in the regular classes of those courses, which assures the program's sustainability.

H. Weaknesses and Threats

Perhaps the single weakest and largest threat to our department is our steady growth in number of our graduate and undergraduate students combined with the substantial 25% reduction in the number of tenure and Tenure track (T/TT) faculty in our department (The reader is referred to the next two figures compiled from departmental data).





We have also experienced substantial growth in the number of our UG physics majors. With the Universities emphasis on QEP and to provide research experience to UG majors this has further exacerbated the already serious situation. With the establishment of the newly accredited medical physics program (18 additional PSM students) this places an undue burden on our faculty.

Based on metrics over the past decade, and based on our initiatives and alignment with College and University strategic goals together with each faculty member's excellent research, service and teaching accomplishments, we believe a substantial increase in hires in the department is indicated.

In addition to the substantial increases in internal student enrollment in physics, we also have seen a steady increase in non-physics majors enrolled in our lower-level classes. The department's top priority hire over the past seven years has been an Associate Instructor hire to help administer our instructional laboratory courses (PHY 2048L. PHY 2049L). Currently we have a single Senior Instructor in this position, and as shown below, this could be viewed as a "single point of failure " for the department. Budget reductions, and dwindling faculty ranks has apparently made this a lower priority.

1) Enrollments of PHY2048L and PHY2049L in recent 6 years

Enrollments	2006	2007	2008	2009	2010	2011	2012	2013	2014
PHY2048L	517	617	599	769	927	920	1050	1066	1044
PHY2049L	421	512	522	575	711	812	773	898	881
Total	938	1129	1121	1344	1638	1732	1823	1964	1925

2) The total enrollments in general physics labs have increased from 938 in 2006 to 1925 in 2014, as a result, a serious lab space problem needs to be resolved ASAP because:
    (a) The lab rooms are still the same as 15 years ago.
    (b) Till now lab room PS 152 is still shared by PHY2049L and Physics Electronics lab;
    (c) Three serious consequences occur:
        (i) Each lab section has too many students so that they cannot get timely help from their lab instructor.
        (ii) Many students are not able to register in their favor lab sections to match their schedules because we don't have lab rooms to offer more lab sections at students' favor hours.
        (iii) The more students are in a lab section the heavier teaching load is put on lab instructor who therefore has less time for his/her graduate study and research.
3) Dr. Chen supervises roughly 60 lab sections each semester in the following way:
    (a) Spends several hours per week to train lab TAs before they teach their lab sections.
    (b) Responds to emergency cases such as sudden computer failure (software or hardware), unexpected malfunction, and damage to lab equipment, students' injuries due to accidents in their measurements because of, for example, short circuits made by them.
    (c) Substitutes for TAs and teach their lab sections if they are late or absent due to unexpected reasons.
    (d) Resolves tensions between students and some TAs by first talking to them individually and then collectively, in a patient and constructive manner so that problems are solved quickly and smoothly.
    (e) Some TAs may give students much higher (or lower) lab grades than others. Dr. Chen checks all the grade reports carefully and makes some necessary adjustments

among different lab sections, and then reports the final lab grades of all lab sections to the university at the end of each semester.

(f) Assists the Chair in making TA assignments every semester since 2005.

4) Dr. Chen received an Award of $118,000 from FAU Technology Fee Committee on May 2, 2013 for renovation and expansion of general physics labs. The following achievements have been made:
   (a) State-of-the-art computer-interfaced data acquisition technologies including PASCO 850 interface, Capstone software, computer-interfaced sensors, Dell OptiPlex 9020 computers will be used in all the computerized experiments for both PHY2048L and PHY2049L starting from spring 2015.
   (b) Two new lab manuals will be published by Kendall Hunt Publishing Company in spring 2015.
      (i) De Haui Chen and Shen Li Qiu, "PHY2048L General Physics 1 Lab Manual" (4th edition).
      (ii) De Haui Chen and Shen Li Qiu, "PHY2049L General Physics 2 Lab Manual" (4th edition).
5) Dr. Chen has taught both lecture and lab courses of "Physics Electronics (PHY3722C)" every spring semester since 1998.
   (1) Dr. Chen has designed 15 very interesting and practical experiments for PHY3722C labs such as digital-analog converters and analog-digital converters, diode and rectifier circuits, alarm system, automated lawn-watering system, digital decoder and digital counter with LED display, wireless light-wave communication etc. Students are very excited when they can make these circuits and devices work independently.
   (2) Dr. Chen has written lab manuals for Physics electronics lab and updated every year.
   (3) Many students strongly suggest that the Physics Department offer Physics Electronics II, which will cover more cutting-edge electronic circuits and devices.
6) As mentioned above, the Laboratory Coordinator's teaching loads is unduly heavy. It is prudent to hire another Assistant Laboratory Coordinator.

Just as its faculty and staff are a primary strength of the Department of Physics, the increased workload imposed on the faculty and staff over the last few years must rank as a primary threat to the department's future. This threat is compounded by the fact that we had a 25% reduction in our T/TT professors and a substantial increase in students across the board and the introduction of a new Professional Science Masters in Medical Physics degree program within the department. The average age of the T/TT professors in the department is 52, and ~25% of the faculty members in the department are over 65. Thus, with a number of retirements imminent, additional tenure-track faculty hiring over the next few years will be crucial to the continued improvement of the physics department.

A related threat to continued faculty strength and morale are faculty salaries. Of particular concern are assistant professor salaries (1 assistant professor with an annual salary of $68K) and associate professor salaries (3 associate professors with an average annual salary of $71K), but full professor salaries are also low (5 professors with an average annual salary of $97K). These salaries place FAU's physics department at the lower quartile of the American Association of University Professors"2013-2014 Faculty Salaries Report" (http://www.aaup.org) of assistant professors ($68K + 3.9% from 2013-14, bottom 22nd percentile for doctoral institutions) and associate professors ($71-1.9% from 2013-14, bottom 5th percentile for doctoral institutions), and full professors ($97,200 +0.5% from 2013-14, bottom 8th percentile for doctoral institutions).

Undergraduate retention and graduation rates are a serious threat to the university, and the Department of Physics shares the university's concern with this problem. The physics department recognizes its responsibility to provide effective instruction to all students, giving them the opportunity to succeed. Numerous innovations and initiatives by the department directed at improving student performance in

physics classes have already been mentioned above, in the "Instruction" section. Two important questions are how does one define and measure student success, and how does one measure the effectiveness of the various innovations and initiatives promoting student success? The first of these questions could be addressed at least in part by this academic program review. (See the first "Question for the Review Team" below.)

I. Resource Analysis

Office Space

We recently converted one of our spacious rooms into an Undergraduate Office where our students could retreat to for the purpose of studying individually or in groups. Knowing that the students have a place to go to specifically designed for them bolsters their morale, encourages cohesiveness, and has increased their extracurricular academic activities. In fact, since they were given this office, they established a new FAU club: the Physics & Astronomy Club. This office gives them a place to not only conduct their club meetings, but to interact with each other on an academic and social basis. Since Freshmen and Sophomores do not generally enroll in upper level classes, this room provides these students the chance to interact with upper classmen and vice versa. Otherwise, the lower classmen would be completely out of touch with the upper classmen. If one looks at the data, this is where we start to lose students the most – at the Freshman and Sophomore levels. We need to work with them and continually stimulate their minds with interesting and fascinating scientific concepts before they transfer out of Physics.

This keyed office has some tables, chairs, an HD flat screen TV, and a basic kitchenette. Though the space itself is maximally utilized, it severely lacks the technology that Undergraduate students expect from a first rate University. It cannot sustain the underlying energy, nor cultivate the thirst for knowledge that our students possess. They want to be engaged in fruitful research and work on big projects, but they do not have the technological resources available to them at their fingertips within the Physics Department. With the newly developed University QEP and the extensive research FAU has been conducting with regard to the efforts used in student retention, transforming our Physics Undergraduate Office into a high-tech "Physics Undergraduate Burrow" falls directly in line with these missions. We had submitted a Tech Fee grant proposal in January 2014 for the purpose of facilitating a thriving and active atmosphere for research and academics among the students, but the proposal was declined.

Human Resources

The Department of Mathematical Sciences currently employs 5 professors, 3 associate professors, 1 assistant professors, 2 visiting assistant professors, 4 non-tenure-track instructors, 3 staff, and 28 graduate students supported by stipends, plus a number of senior undergraduates working as tutors and graders for our entry-level classes. The total number of faculty has barely changed since the last program review six years ago; however, a shift in emphasis away from T/TT faculty (reduction by 25%) and research in favor of instructional non-tenured faculty (increase by 25%). However, strategic goals places on our Department from the University and College continued to emphasize research. The number of supported graduate students has decreased by 6; and the number of staff has remained constant at 3. Perhaps the most damaging budget cut to our program was a University-mandated reset to the 2009 budget. For some Departments this meant a windfall, but for Physics it resulted in the 25% decrease in faculty and the hiring of no graduate students in the 2012-2013 academic year. This continues to have a rippling effect on our once rock stable PhD program. Nevertheless, we are beginning to recover. The department also hires one adjunct instructor each semester, usually chosen from our Emeriti.

Enrollments over the last five years (from fall 2009 through fall 2014) have exploded without a corresponding increase in faculty size: While PhD graduate enrollments relatively steady over this period, our newly-formed and accredited Medical Physics Program has added 18 new Professional Science Masters to our program, and this is steadily increasing. Undergraduate enrollments increased by more than 43%, from 4379 to 6268. Accommodating these burgeoning enrollments without increasing the size of the faculty required creative scheduling and a steady increase in average class sizes. (See the subsections "Average Class Size and Faculty/Student Ratio" and "Faculty Teaching Load.") This

"creative scheduling" has its limits, as does availability of large classrooms, and the physics department appears to have reached this limit. This problem is exacerbated by pressures to improve student performance because of the university's need to increase retention and graduation rates. Increasing class sizes in lower-division physics classes may well have hampered efforts to raise the pass-rate in those classes.

As noted above, a priority of the physics department has been to supervise the graduate students' teaching, both to improve the quality of instruction and to provide professional training for the graduate students as future academics. Nevertheless, the substantial increase in the size of our doctoral/PSM programs together with the 25% reduction in the number of faculty places an increasing burden on these faculty, who must supervise both the research and the teaching of these graduate students, and puts the quality of the doctoral and PSM programs at risk.

As mentioned the Department of Physics currently has approximately the same number of full-time faculty as at the last program review six years ago. Given the growth in the graduate programs, the need for tenure-track faculty hiring is especially acute, and given the anticipated retirement of senior faculty in the next few years, this hiring needs to begin almost immediately. The same hold true for our service courses and our general UG enrollment in the University. We need an Assistant Laboratory Coordinator.

Space Needs

The department seeks to construct an instructional computer lab introduce computation science systemically into its core courses. We are already implementing computational projects into our graduate and undergraduate course. We also need proper tutoring space within the Science building or in an adjacent building. Given the number of TA's and the tight office space for our PhD students, tutoring is a severe disruption to the studies and research of our graduate students.

Funding

- As noted under "Weaknesses and Threats," faculty salaries (especially among newer faculty) are low. Graduate stipends have not changed in more than ten years and are also quite low.

- Expense funding is currently low, and the department finds it difficult to support faculty and graduate student travel to professional meetings. Travel to professional meetings promotes research contacts, which in turn improve chances for successful external grant funding. Ultimately this grant funding can be used to supplement expense money for travel, and the department expects more successful research grants in the future to take some of the pressure off of expense funding.

- Start-up funding for new experimental faculty has not been supported, and we understand that this is the primary reason why a request for a hire of an Assistant Professor in experimental physics was not approved. As an alternative, the faculty and Chair and now concentrating on an experimental thrust for the Jupiter campus in biophotonics that will support the Provost and President's newly emerging strategic plan.

J. Future Directions

Anticipated Changes

The anticipated changes discussed here are items on which to focus the physics department's efforts over the next few years. These changes are grouped into four categories, the first of which will require significant funding from the university, and the remainder of which are primarily the responsibility of the department.

To secure the future of its faculty, the physics department must hire tenure-track faculty on a regular basis over the next several years, ideally one or two new hires each year. The department must also make faculty salaries competitive with those of physics departments at peer universities, especially for those faculty hired in the last ten years who are the foundation for the future of the department.

The physics department must continue to encourage faculty to seek external research funding. The department must also continue to encourage faculty to take advantage of interdisciplinary research opportunities in the university, as a way of strengthening physics within the department and strengthening the department within the college and university.

The physics department must include a computational science course into its undergraduate degree programs so that its majors will be better prepared for their careers. The department must also encourage faculty, where appropriate, to incorporate project-based and discovery learning techniques in their classes and promote undergraduate research and honors among their students.

The physics department and the university must continue to work to improve student performance, retention rates, and graduation rates. The department and university have already implemented a number of initiatives aimed at improving student success, and the physics department must be a part of these. The physics department, with the support of the university, must take the lead in studying the effectiveness of these initiatives on student success especially in the IFP courses within the department.

Questions for Review Team

1. Are there any particular physics-specific measures or definitions student success that you use in your department, and how do one these measure the effectiveness of the various innovations and initiatives promoting student success?
2. What are effective strategies for increasing research grant funding in general relativity for our FAUST group, and for our effort in Medical Physics?
3. What is reasonable staffing (faculty, student) for the 60 sections of instructional laboratories in the department?
4. What do you view as the top three critical issues for our department?
5. How can we enhance student retention of lower-level UG physics majors; should we increase admission requirements for our department?
6. Can we be a viable department in the field of physics without an experimental component?
7. How might we recruit more US students for our undergraduate and graduate degree programs?
8. How do we effectively advertise our strengths to the wider academic community (one of the largest GR groups in the country, our newly accredited PSMMP program with superior results of our students passing the ABR exams)?
9. I had to remove the question "What are good strategies for bringing faculty salaries up closer to the national average?" as it was too broad, so disregard this question.

K. Student Feedback

The Department of Physics Chair and Staff meets with the graduate students three or four times per year. The purpose of this meeting is to discuss topics of interest to the graduate student body of the department, two discuss the Chair's initiatives for the semester (based on their feedback from previous meetings, faculty meeting feedback and assessment feedback) and to hand out teaching assignments for the semester (or summer term).

In our most recent meeting, we discussed the self-evaluation, the process of the external evaluation as well as new initiatives of the Department, College and University. We report here of the student feedback on the following questions:

Graduate Student Questionnaire[2]

1. *What has been your experience thus far as a Graduate Student in the Physics Department?*
   All of the students have stated that they have had a positive experience during their time as a Graduate Student in the Physics Department on both academic and personal levels. They feel like the environment in the Physics Department is welcoming and friendly from the time of their admission process to the first day that they arrive on campus all the way to the present. They feel that the Physics Department cares about them and their needs.

2. *Are you progressing toward all of your academic targets in a timely fashion?*
   Most of the students feel that they are adequately progressing toward their academic goals in a timely fashion. However, one student stated that he was hitting his academic targets a bit more slowly due to reasons beyond his control, i.e. his Adviser left FAU, therefore the student had to change advisors.

3. *Who specifically has been helpful to you within the Physics Department?*
   A large number of the students stated that *everyone* in the Physics Department has assisted them in some form or another. Most of the students stated in different combinations that various Faculty members and Staff members have helped them with all kinds of issues and problems. All problems were either resolved within the Department or students were directed to the appropriate office that could resolve their issues.

4. *What are some good things that have happened to you since becoming a Physics Graduate Student?*
   Many good things have happened to the Physics Graduate Students since becoming Physics majors. Some students stated that the learning environment of the Physics Department is excellent and that their Physics Professors are flexible and strive for excellence among their students. For this reason some students stated that they are significantly better at studying, focusing on coursework, managing and working in high pressure situations, and focusing on their futures. Some students declared they are happy to be a part of the new Medical Physics Program and its rapid development with the CAMPEP accreditation. They like the fact that they are able to work on-site in hospitals with professional Medical Physicists. Others stated that the Physics

[2] The completed questionnaires can be made available to the review committee.

Department has given them great opportunities to conduct research and present their research at national and international conferences. Additionally along the lines of research, students were thrilled to have the opportunities to conduct summer research at Harvard University, the Air Force Research Laboratory in Rome, NY, Oak Ridge National Laboratory and Argonne National Laboratory. One student was able to attend two fall schools at the Friedrich-Alexander-University in Erlangen-Nuremberg, Germany as well as conducting a weeklong research trip to the Hearne Institute for Theoretical Physics at Louisiana State University. These trips and research programs provide students with extensive and unique experiences, valuable academic connections, and future career networking resources.

5. *What are some things/resources that you do not have that would be helpful to you?*
   Though our students overall are happy with student life, they are highly concerned with their finances as Teaching Assistants. The cost of living in Boca Raton has seen a substantial increase, while student stipends have not increased in many years. Between student fees, health insurance, rent, utilities, and other normal month-to-month expenses, the students find themselves living paycheck to paycheck which causes an undue amount of stress that they should not have to worry about.
6. *What are some things that you would like to see happen within the Physics Department?*
   Several students would like to see Faculty hires within the field of biophysics and condensed matter physics in order to facilitate thriving experimental groups for their own research. Some students would like to see more travel funds available to them for the purpose of presenting their research. As it stands, the Physics Department has a policy that matches any travel funds given to them by the FAU Graduate Student Association. Unfortunately, for as many conferences and workshops that students are eligible to attend or do actually attend, the Physics Department's limited expense budget cannot fund all of these trips for the students.
7. *Do you feel that when you do have a problem that a Faculty or Staff member is accessible to talk to you?*
   All of the students answered a resounding "yes" to this question. Some students mentioned that doors are always open for them and that Faculty and Staff are easily accessible and always willing to listen to their questions and concerns. To quote some of the students' answers, "I have seen that when I have problems, the faculty or staff members are easily accessible to talk to me, give me some feedback, and even suggestions.", "I see that they are available and they are efficient to answer and solve the problem together with us and I appreciate that.", "I feel like I am living in a big family." The Physics Department takes great pride in cultivating this supportive type of environment and maintaining a unified cohesiveness for all of our students.

The physics department collects, assesses and addresses issues from student feedback on each of their degree programs. The department also and utilizes the "Student Perception of Teaching" responses as a measure of the quality of instruction in physics as compared with college and university averages.

Scale 1=Excellent 5=Poor	**20. Rate the quality of instruction as it contributed to your learning in the course.**

		Physics			College Total	University Total
		2010-2011	2011-2012	2012-2013	2012-2013	2012-2013
Undergraduate	**# Sections**	153	147	208	1,510	5,771
	Mean Rating	**1.8**	**2**	**1.9**	**2.0**	**1.9**
Graduate	**# Sections**	17	13	15	130	1,016
	Mean Rating	**1.8**	**2**	**2.2**	**1.7**	**1.7**
Total	**# Sections**	170	160	223	1,640	6,787
	Mean Rating	**1.8**	**2**	**1.9**	**2.0**	**1.8**

*Chart E1 Rating of Quality of Instruction (item 20) and Instructor (item 21) from Student Perception of Teaching (SPOT) under Efficiency Data in DDI

Scale: 1=One of Most Effective 5=One of Least Effective		**21. What is your rating of this instructor compared to other instructors you have had?**				
		Physics			**College Total**	**University Total**
		2010-2011	**2011-2012**	**2012-2013**	**2012-2013**	**2012-2013**
Undergraduate	**# Sections**	153	147	208	1,510	5,771
	Mean Rating	**2.1**	**2.2**	**2.1**	**2.2**	**2.0**
Graduate	**# Sections**	17	13	15	130	1,016
	Mean Rating	**1.9**	**2.1**	**2.2**	**1.9**	**1.9**
Total	**# Sections**	170	160	223	1,640	6,787
	Mean Rating	**2.1**	**2.2**	**2.1**	**2.1**	**2.0**

*Chart E1 Rating of Quality of Instruction (item 20) and Instructor (item 21) from Student Perception of Teaching (SPOT) under Efficiency Data in DDI

For both the "quality of instruction" and the "quality of instructor" questions, the mean rating for graduate and undergraduate classes is comparable to college and university means. Without having the data broken into class sizes and level (large lower-division service classes versus small upper-division classes for physics majors), it is difficult to interpret this data or how it applies to the physics programs. The Chair has not places substantial weighting on these numbers for assessment and planning purposes. The Chair has utilized the Master Teacher evaluations on faculty as the primary input for these decisions and for annual evaluations of the faculty.

Appendix 1: Student Learning Outcomes Assessment

CONTENT KNOWLEDGE (Declarative Knowledge): Graduates in Physics will understand basic concepts, theories, and experimental findings in four core areas of physics: particle and wave mechanics, electricity and magnetism, thermodynamics and modern physics.

CONTENT KNOWLEDGE (Research Skills) and CRITICALTHINKING (Analytical Skills, Practical Skills): Graduates in Physics will demonstrate an understanding of scientific methodology and will apply their knowledge to laboratory assignments that demonstrate each student's understanding of (1) the nature of scientific explanations, (2) threats to the validity and reliability of observations, (3) the limitations of measurement scales, (4) the use of experimental and quasi□experimental designs to test hypotheses and (5) the proper interpretation of experimental data.

In each of the following courses, exams, term papers and laboratory reports will be used to assess each student's knowledge of the subfield of physics.
PHY 2048 and PHY 2048L: General Physics I and Lab PHY 3101: Modern Physics
PHY 2049 and PHY 2049L: General Physics II and Lab PHY 3221: Intermediate Mechanics

PHY 3323: Electromagnetism I
In these courses, students will also complete homework problems, tests and laboratory assignments that require abstract critical thinking and sound scientific methodology in applying the fundamental laws of physics to diverse and applied situations.

COMMUNICATION (Written Communication): Graduates in Physics will be able to produce writing that is grammatically correct, well□organized, and properly formatted and in accord with the guidelines and styles described in the Department′s Physics Laboratory Manuals.

COMMUNICATION (Graphic Communication): Graduates in Physics will be able to produce and interpret charts, graphs and tables that effectively and accurately display data, relationships and principles.

Students will be required to complete laboratory courses (PHY 2048L, PHY 2049L and PHY 4811L) in which they will complete laboratory reports that require written and graphical components as appropriate to the assignment. In each of the following laboratory courses, students will write laboratory reports in accordance with the guidelines and styles described in the Department's Physics Laboratory Manuals:

PHY 2048L: General Physics Lab I PHY 2049L: General Physics Lab II
PHY 4811L: Experimental Modern Physics (required for BS in Physics majors only)

Approved 3□16□2006

Appendix 2: Graduate Annual Evaluation Form

Instructions:

The procedure for filing this report with the Department is as follows:

1. Student:

(A) Complete page 1 of this electronic form. (B) Fill in the attached Course Spreadsheet (preferably in ods format with e.g. LibreOffice). (C) Send this form and the spreadsheet to your Thesis Advisor and schedule a meeting with your Thesis Committee to present a summary of your research progress during the past year.

2. Advisor:

(A) Complete your assessment of the students academic performance on page 2. (B) Meet with the student to discuss it. (C) Collect electronic copies of this form and the Course Spreadsheet. Keep one set of copies for yourself, give one to the student, and email a copy of this form and the Course Spreadsheet to the Graduate Advisor. The student may appeal any part of his or her advisors evaluation in writing to the Department Chair.

Graduate Student Annual Report to the Physics Department

Academic Progress

(to be completed by the student)

Name:

Z-Number: Date of Report: Degrees sought: (e.g. PHD, MS, MSMP, ...)

Current GPA: Credits below 3.0: Date of Entrance into Program:

Qualifiers Passed: ☐ Mechanics ☐ Electromagnetism ☐ Statistical Mechanics ☐ Quantum Mechanics

Date admitted to Candidacy:

Degrees received from FAU Physics:

Thesis Advisor:

Other Committee Members:

Thesis Topic:

Remaining Required Courses:

Degrees for which Plan of Study is filed with Grad College: (e.g. PHD, MS, MSMP, ...)

Degrees for which Application for Degree is filed: (e.g. PHD, MS, MSMP, ...)

Output during entire time as FAU Physics Grad Student (Publications [indicate if peer-reviewed], Presentations, Posters, Meetings):

Date	Description

Graduate Student Annual Report to the Physics Department

Academic Performance (to be completed by the advisor)

Summarize this students accomplishments since his or her last report. (Attach pages as needed.)

Summarize your anticipated goals for this students next report. (Attach pages as needed.)

Summarize any concerns you may have regarding this student. (Attach pages as needed.)

Advisor: By putting your name and the date below you indicate that you have discussed the contents of this progress report with the student, and the student has presented on his or her progress to the Thesis Committee. After adding your name please email a copy of this form to the graduate advisor.

Advisor Name:

Date:

Appendix 3: Sample Faculty Annual Evaluation Form

FACULTY PERFORMANCE EVALUATION 2013

FACULTY MEMBER: Albert Einstein

	Excellent	Above Satisfactory	Satisfactory	Below Satisfactory	Unsatisfactory
1. Research	X				
2. Teaching					X
3. Grants					X
4. Service					X
Overall	X				

Statement of Evaluation by the Chair:

1. RESEARCH Great job on the General Theory of Relativity, The Special Theory of Relativity and the Nobel Prize for the Photo Electric Effect, among other major accomplishments continue to garner high citations.
2. TEACHING: I haven't been able to convince you to teach a single course since April, 18 1955.
3. GRANTS:[3] I encourage you to submit a proposal for federal funding this fall, perhaps in the capacity of Co-PI. Your grant activity has been lacking for the past 50 years.
4. SERVICE: You have not gone to a single committee meeting at FAU that I have assigned you to for the past 50 years.
5. OVERALL: Based on your citation, and scientific impact, and indirect positive impact on all students each and every day, I would be remiss not to give you the highest evaluation. I do hope your citations and impact on student learning and research continues to be as strong. I doubt you need to do any more to ensure this. Great job Albert!

Chair (Electronic Signature) 15 May 2013

Chair, Department of Physics Date

_____ _____

Faculty Member[4] Date

[3] *Externally funded research will be awarded a rank of Excellent, proposals(s) submitted will be assigned a Above Satisfactory, no proposals submitted given needs Unsatisfactory.*

[4] *If the faculty member disagrees with the Chair's evaluation, he or she may attach a statement specifying the reasons for the disagreement. The faculty member may also submit a memorandum in support of the rank score believed appropriate.*

Appendix 4: Faculty Abbreviated CVs

Christopher Beetle

Associate Professor, Department of Physics

561-297-4601 cbeetle@physics.fau.edu

Professional Preparation

PH.D. IN PHYSICS **AUGUST 2000**

The Pennsylvania State University, State College, PA Thesis: *Isolated horizons and black hole mechanics.*

A.B. IN PHYSICS **JUNE 1994**

University of Chicago, Chicago, IL

Appointments

ASSOCIATE PROFESSOR **2009 — PRESENT**

Florida Atlantic University, Boca Raton, FL

ASSISTANT PROFESSOR **2003 — 2009**

Florida Atlantic University, Boca Raton, FL

RESEARCH PROFESSOR **2002 — 2003**

University of Utah, Salt Lake City, UT

POSTDOCTORAL FELLOW **2000 — 2002**

University of Utah, Salt Lake City, UT

Selected Peer-Reviewed Publications

C. Beetle and S.M. Wilder. A note on axial symmetries. Submitted to *Class. Quantum Grav.*

C. Beetle and S.M. Wilder. Perturbative stability of the approximate Killing field eigenvalue problem. *Class. Quantum Grav.* **31** (2014) 075009.

S. Cisneros, G. Goedecke, C. Beetle, M. Engelhardt. On the Doppler effect for light from orbiting sources in Kerr-type metrics. Submitted to *Mon. Not. R. Astron. Soc.*

C. Beetle and J. Engle. Entropy of generic quantum isolated horizons. *Journal of Physics: Conference Series* **360** (2012) 012037.

C. Beetle and J. Engle. Generic isolated horizons in loop quantum gravity. *Class. Quant. Grav.* **27** (2010) 235024.

Selected Other Publications or Grants

Adaptive optics for two-photon microscopy. Max Planck Florida Institute student fellowship grant. Awarded $25k. 2011—2012.

Orbiting binary black holes: From the post-Newtonian regime to the innermost stable circular orbit by combining initial data sequences and numerical evolution. NSF Gravity Theory grant with W. Tichy and P. Marronetti. Award PHY-0555644. 2006—2008.

Mathematical physics for gravitational wave astronomy. NSF Gravity Theory grant. Award PHY-0400588. 2004—2008.

The periodic standing-wave approximation for binary coalescence. NASA Astrophysics grant with R. Price, B. Bromley, and J. Friedman. Award ATP03-0001-0027. 2004—2008.

Synergistic Activities

Referee/Reviewer: NSF Gravity Theory, *Am. J. Phys.*, *Class. Quantum Grav.*, *Gen. Rel. Grav.*, *J. Math. Phys.*, *Phys. Rev. D*, *Phys. Rev. Lett.*

Committees: Academic Freedom and Due Process Committee • Academic Planning and Budget Committee (Chair) • College of Science Graduate Curriculum Committee • College of Science Interim Dean Search Committee • Department of Physics Curriculum Committee (Chair) • Florida Common Prerequisite Discipline Committee • Post-Tenure Review Committee • Secondary Teacher Education Coordinating Committee • University Faculty Senate (President Elect) • University Faculty Senate Steering Committee • University Graduate Council

Other Activities: Department of Physics undergraduate curriculum revision, LaTeX development (fauthesis document class, dirac and faust packages)

Public Lectures: Astronomical Society of the Palm Beaches • FAU Frontiers of Science lecture series • Q&A following a screening of the film *Particle Fever*

Courses Taught

Undergraduate: Quantum Mechanics I (PHY 4604, 4 cr.) • Quantum Mechanics II (PHY 4605, 3 cr.) • Mathematical Methods for Physics (PHZ 3113, 3 cr.) • Special Relativity (PHZ 5606, 3 cr.)

Graduate: Graduate Colloquium (PHY 6920, 1 cr.) • Canonical Gravity (PHY 6938, 3 cr.) • General Relativity (PHY 6938, 3 cr.) • Quantum Field Theory (PHY 6938, 3 cr.) • Mathematical Physics (PHZ 5115, 3 cr.)

Curriculum Vitae (2014)

Dr. De Huai Chen

Faculty and Lab Coordinator of Physics, Florida Atlantic University

Education

B.A. Physics 1969 Fudan University, Shanghai, China.

M.A. Physics 1983 City College of City University of New York. Ph. D. Physics 1987 City College of City University of New York. Dissertation Advisor: Professor Robert Callender.

Dissertation Title "Studies of Substrates Bound to Horse Liver Alcohol Dehydrogenase: Raman Spectroscopy of NAD+, NADH and DABA in situ".

Postdoc 1987 – 1993 Department of Physics, Brookhaven National Laboratory, USA. Postdoctoral Mentor: Dr. Myron Strongin.

Employment

Department of Physics, Florida Atlantic University

1998 – Present Faculty and Laboratory Coordinator, Department of Physics

1995 – 1998 Adjunct Instructor Emulsion Systems Inc.

1993 – 1995 Research Chemist

Department of Physics, Brookhaven National Laboratory

1992 – 1993 Assistant Physicist

1987 – 1992 Research Associate

Books published and to be published

1. Two textbooks (editions 1, 2, 3) have been published:
   (a) D Haui Chen and Shen Li Qiu, "PHY2048L General Physics 1 Lab Manual", (Copley Custom Textbooks, an Imprint XanEdu Publishing, Inc.), 1st edition 2009, 2nd edition 2011, 3rd edition 2013.
   (b) D Haui Chen and Shen Li Qiu, "PHY2049L General Physics 2 Lab Manual", (Copley Custom Textbooks, an Imprint XanEdu Publishing, Inc.), 1st edition 2009, 2nd edition 2011, 3rd edition 2013.
2. Fourth edition of the two textbooks "PHY2048L General Physics 1 Lab Manual" and "PHY2049L General Physics 2 Lab Manual" will be published by Kendall Hunt Publishing Company in spring 2015.

Technology Fee Award and renovation and expansion of general physics labs

1. I received an Award of $118,000 from FAU Technology Fee Committee on May 2, 2013 for the renovation and expansion of general physics labs.
2. State-of-the-art computer-interfaced data acquisition technologies including PASCO 850 interface, Capstone software, computer-interfaced sensors, Dell OptiPlex 9020 computers are used in all the computerized experiments for both PHY2048L and PHY2049L.
3. Several new experiments such as "Atwood's machine", "Ideal gas law" and "Vibrating string" are introduced.
4. Hand-on experiments in both PHY2048L and PHY2049L are enhanced.
5. New edition lab manuals of both PHY2048L and PHY2049L have been written and will be available in spring 2015.

Awards

Outstanding Contributions Award from FAU President Anthony James Catanese, June 26, 2002.

Teaching

(a) Teach and supervise courses at FAU

1995 ---- Present	Physical Electronics (PHY3722C --- lecture & lab)
1995 ---- Present	General Physics labs (PHY2048L and PHY2049L)
1995 ---- 2012	Modern Physics lab (PHY4811L)
1996, 1998, 2002	Modern Physics (PHY3101C --- lecture)
1997	General Physics 2 (PHY2049 --- lecture)

(b) Supervise teaching labs (PHY2048L, PHY2049L)

Enrollments of PHY2048L and PHY2049L in recent 6 years

Enrollments	2006	2007	2008	2009	2010	2011	2012	2013	2014
PHY2048L	517	617	599	769	927	920	1050	1066	1044
PHY2049L	421	512	522	575	711	812	773	898	881
Total	938	1129	1121	1344	1638	1732	1823	1964	1925

Lab sections: In fall 2014 there are 30 lab sections in PHY2048L and 28 in PHY2049L.

- I spend several hours per week training lab TAs before they teach their lab sections, in order to ensure high teaching quality and maintain the same standard in 58 lab sections. I review the physics principle used in the experiment, help them set up the equipment step by step, run the program to collect data, show them what are possible common mistakes, and how to quickly find and resolve the problems. TAs are confident teaching their lab sections when they are equipped with such first-hand experiences and their own data.

  Moreover, I also occasionally attend a new TA's first-time lab section, as well as those with the most problems reported by students.

- I always substitute for TAs and teach their lab sections if they are late or absent due to unexpected reasons.
- I respond quickly to emergency cases such as sudden computer failure (software or hardware), unexpected malfunction, and damage to lab equipment.

- I resolve tensions between students and some TAs by first talking to them individually and then collectively, in a patient and constructive manner so that problems are solved quickly and smoothly.
- Some TAs may give students much higher (or lower) lab grades than others. I check all the grade reports carefully and make some necessary adjustments among different lab sections, and then report the final lab grades of all lab sections to the university at the end of each semester.

(c) Make Physical Electronics course (PHY3722C) attractive and exciting to students

- I have more than ten years of experience in designing and manufacturing integrated circuits before I came to the USA in 1981. These valuable experiences have been incorporated into my teaching of the Physical Electronic course, which includes both lecture and labs. I have designed 15 very interesting and practical experiments for PHY3722C labs such as digital-analog converters and analog-digital converters, diode and rectifier circuits, alarm system, automated lawn-watering system, digital decoder and digital counter with LED display, wireless light-wave communication etc. Students are very excited when they can make these circuits and devices work independently. Many students strongly suggest that the Physics Department offer Physics Electronics II, which will cover more cutting-edge electronic circuits and devices.
- I have written lab manuals for PHY3722C lab and updated them annually.

Department Services

(a) Make TA assignments every semester since 2005 (Category B).

(b) Member of the Building and Space committee since 2005 (Category B).

Note: Category B - Service for which no remuneration or time is allotted.

Community services and synergistic activities

(a) The Department of Physics holds the Pumpkin Drop and Physics Carnival on Halloween every year, which hosts about 200 5th and 6th grade students from the Henderson schools. I participate in this event every year, make ice cream for the kids and show them how it is made from liquid nitrogen. Kids love it very much.

(b) Supervisor for Florida Science Olympiad Circuit Lab (C) 2/15/2014.

(c) I have been involved in the “Science Fair” for middle school students for many years. I often show them physics demonstrations and encourage them to learn science.

(d) Dr. Qiu and I have been actively involved in the "Partners in Science” summer program with high-school teachers and students for many years. We show them physics demonstrations as well as our computerized labs, and let them put their hands on some experiments in our

teaching labs. The aim of these activities is to encourage and guide able students toward careers in science.

Refereed Publications

(1). D. H. Chen. K. T. Yue, C. L. Martin, K. W. Rhee, D. L. Sloan & R. Callender, "Classical RamanSpectroscopic Studies of NADH and NAD+ Bound to Liver Alcohol Dehydrogenase by Difference Techniques", Biochernistry, 26, 4176, (1987).

(2). K. T. Yue, C. L. Martin, D. H. Chen, P. Nelson, D. L. Sloan & R. Callender, "Raman Spectroscopy of Oxidized and Reduced Nicotinamide Adenine Dinucleotides", Biochemistry,25 4941, (1986).

(3). R. Callender, D. H. Chen, J Luglenberg, C. Martin, K. W. Rlee, D. L. Sloan, R. Vandersteen & K. T. Yue, "The Molecular Properties of the Substrate DABA when Bound to Liver Alcohol Debydrogenase by Raman Spectroscopy". Biochemistry, 27. 3673, (1988)

(4). H. Wiesmann, D. H. Chen, R. L. Sabatini, J. Hurst, J. Ochab and K W. Ruckman, "Effect of Stoichiometry and Post-Annealing Conditions on Magnetron Sputtered Films of $YBa_2Cu_3O_7$ on Cubic Zirconia", J.Appl. Phys. 65, 1644 (1989).

(5). D. H. Chen. R. L. Sabatini. S. L. Qiu, D. Di Marzio, S. M Heald and H. Wicsrnann." Superconducting Ti-Ca-Ba-Cu-O thin films by Reactive Magnetron Sputtering", in: American Institute of Physics Conference proceedings No.182, edited by G. Margaritondo, R. Joynt and M. Onellion, New York, 1989, p.74.

(6). M. W. Ruckman, D. H. Chen, A. R. Moodenbaugh, S. M. Heald, S. L. Qiu,. C. L. Lin, Myron Strongin. D. Nichols and J. E. Crow, "Modification of $YBa_2Cu_30_{7-x}$ ceramics by Adsorbed Water and Other Gases", in: Processing & Applications of High Tc Superconductors, Edited by: W. E. Mayo, 1988, p241.

(7). S. L. Qiu, C. L. Lin, M. W. Ruckman, D. H. Chen, Myron Strongin, D. Nichols and J. E. Crow, " Interaction of CO, $C0_2$ and H_2O with Ba and $YBa_2Cu_3O_7$ ", in: American Institute of Physics Conference Proceedings No. 182, edited by G. Margaritondo, R. Joynt and K Onellion, New York, 1989, p.368.

(8). D. Dimazio, H.Wiesmarn. D. H. Chen and S. M. Heald, "XAFS Studies of Superconducting $Tl_2CaBa_2Cu_2Ox$ Thin films", Phys. Rev, B**42**, 294 (1990).

(9). P. M. Gehring, Henry Chou, S. M. Shapiro, J. A. Hriljac, D. H. Chen, J. Toulouse, D. Rytz, and L. A. Boatner, "Dipole-glass behavior of lightly doped $Kta_{1-x}Bb_xO_3$", Phys. Rev. B 46, 5116 (1992).

Dr. Jonathan S. Engle
Assistant Professor of Physics

Department of Physics	Phone:	+1-561-353-6423 +1-
Florida Atlantic University	Fax:	561-297-2662
777 Glades Road	Email:	jonathan.engle@fau.edu
Boca Raton, FL 33431		

Education

B.S.	2001:	Mathematics and Physics, University of Dallas
Ph.D.	2006:	Physics, The Pennsylvania State University Adv.: Abhay Ashtekar

Appointments:

2012-Present:	Affiliate Professor of Physics (courtesy appointment)	Friedrich-Alexander-Universit¨at, Erlangen	
2010-Present:	Assistant Professor of Physics	Florida Atlantic University	
2008-2010:	Post-doctoral Fellow (Humboldt)	Albert Einstein Institute, Potsdam, & Friedrich-Alex.-Univ., Erlangen	Host: Thomas Thiemann
2006-2007, 2009:	Post-doctoral Fellow (NSF)	Centre de Physique Th´eorique, Marseille	Host: Carlo Rovelli
2002-2005	Research and Teaching Assistant	Pennsylvania State University	Advisor: Abhay Ashtekar
2001-2002	Pennsylvania State Univ. Fellow	Pennsylvania State University	

External Funding Awards:

As professor:

- $ 25,000 (2012-2013) NASA Florida Space Grant Consortium Research Grant, *Loop Quantum Gravity Dynamics from the CMB Missions*
- $ 5,000 (2012) NSF Grant supporting travel for U.S. Graduate Students and Postdocs for the 2nd BNU International Summer School on Quantum Gravity
- $120,000 (2012-2015) NSF Gravitational Theory Grant, *Dynamics and Symmetry in Quantum Gravity*
- $4,000 (2011) Oak Ridge Associated Universities Event Grant, in support of the 6th Gulf Coast Gravity Meeting

As post-doctoral researcher:

- e61,800 (2008-2010) Alexander von Humboldt Foundation: Post-Doctoral Fellowship for U.S. Scientists and Scholars
- $121,100 (2006-2007, 2009) NSF: International Research Fellowship

Other honors:

- Nomination by FAU for the Blavatnik Award for Young Scientists, 2014.
- Nomination by FAU for the ORAU Powe Junior Faculty Enhancement Award, 2012.
- Frymoyer Honors Scholarship, 2004 and 2005.
- Duncan Fellowship, 2005.
- Roberts Fellowship, 2001-2003.

- Pennsylvania State University Fellowship, 2001-2002.

Languages: English (native), French (fluent) and German (fluent).

Service:

- Chair of Graduate admissions in physics at Florida Atlantic University (2012-present) • Grant reviewer for NSF, NASA, and the Louisiana Board of Regents Support Fund
- Invited NSF review panelist, 2014.
- Referees regularly for *Classical and Quantum Gravity*, *Physical Review Letters*, and *Physical Review D* as well as other journals.
- Organizer of the 6th Gulf Coast Gravity Meeting (2011).

- Chair of selection committee for financial aide to U.S. attendees of the 2nd BNU International Summer School on Quantum Gravity

Theses advised: Thomas Zilker, B.S. in Physics, Friedrich-Alexander-Universit¨at, Erlangen.

Current advisees: Atousa Chaharsough Shirazi (Ph.D.), Matthew Hogan (Ph.D), Phillip Mendonca (Ph.D.), and Ilya Vilenskiy (Ph.D.)

Courses taught

As instructor at FAU

- Quantum Mechanics II (undergraduate), Spring 2011, 2013
- Mathematical Methods for Physics (undergraduate), Fall 2011, 2012, 2013, 2014
- Mathematical and Quantum Gravity (graduate), Spring 2012

As assistant at Penn State

- General physics: Fluids & thermal physics, Summer 2002; Wave motion & quantum physics, Summer 2002; Electricity & magnetism, Fall 2002 & Spring 2005; Mechanics, Spring 2004.
- Modern physics, Spring 2003.
- General relativity I, Fall 2003.

H-index: 16; **Average citation per published paper**: 54. *(Source: HEP INSPIRE)*

Invited book chapters

J.Engle and T.Liko "*Isolated horizons in classical and quantum gravity*", book chapter in *Black Holes: New Horizons*, ed. S. Hayward, Singapore: World Scientific (2013).

J.Engle "*Spin Foams*", book chapter in *The Springer Handbook of Space-time*, ed. A.Ashtekar and V.Petkov, Heidelberg: Springer-Verlag (2014).

Last five other peer reviewed publications

A.Chaharsough S. and J.Engle "*Purely geometric path integral for spin foams*", Class.Quantum Grav. **31** (2014) 075010.

J.Engle "*Embedding loop quantum cosmology into loop quantum gravity without piecewise linearity*" Class.Quant.Grav. **30** (2013) 085001[5].

J.Engle "*A spin-foam vertex amplitude with the correct semiclassical limit*" Phys.Lett. B**724** (2013) 333337.

J.Engle "*A proposed proper EPRL vertex amplitude*" Phys.Rev. D**87** (2013) 084048.

C.Beetle and J.Engle "*Generic isolated horizons in loop quantum gravity*" Class.Quant.Grav. **27** (2010) 235024.

Invited Summer School Lecture Series

- *Isolated Horizons and Black Hole Entropy in Loop Quantum Gravity* (4 lectures), at the 2nd Beijing Normal Univ. International Summer School on Quantum Gravity, August 13-18, 2012.

Invited Plenary Lectures and Discussion Panelist roles

- *Loop quantum gravity spin-foam models*(Plenary lecture); Beijing Normal University, "Loops '09," August 5, 2009.
- *Round table on black hole entropy* (Invited panelist); Penn State Univ., "Quantum Gravity in the Americas III", 26 Aug., 2006.

Last five other invited talks

- *Dynamical cosmological sector in loop quantum gravity*; Institute for Theoretical Physics, University of Warsaw, Quantum Gravity Seminar, Nov. 28th, 2014
- *Gravity, quantum, loops, and cosmology*; University of Miami, Physics Colloquium, Nov. 20, 2013.
- *Spin-Foams: Key classic results and recent developments*; Florida Atlantic University, Physics Colloquium, Sept. 7, 2012.
- *Plebanski sectors, orientation, and spin-foams*; Chern Inst. for Mathematics, Tianjin, China. XXIX International Colloquium on Group-Theoretical Methods in Physics, August 22, 2012.
- *Plebanski sectors of spin-foam models*; Institute fu¨r Theoretische Physik III, Friedrich-Alexander-Universit¨at, Erlangen, May 30, 2012.

[5] selected as a Classical and Quantum Gravity highlight

Vita J. S. Faulkner
Professor Emeritus, Department of Physics
Associate Director, Center for Biological and Materials Physics
Florida Atlantic University

Education:
Ph. D., Physics, The Ohio State University.
M. S., Physics, Auburn University.
B. S., Physics, Auburn University.

Work record:
2003- , Professor Emeritus
1986-2003, Professor, Department of Physics, Florida Atlantic University.
1962-1986, Metals and Ceramics Division, Oak Ridge National Laboratory, Organized and headed Theory Group.
1959-1962, Assistant Professor, Physics Department, University of Florida.

Honors:
2008, Chosen as **Outstanding Referee** by Editors of APS journals.
1998, **Professorial Excellence Program Award**, Florida Atlantic University.
1990, **Outstanding Achievement Award**, Florida Atlantic University.
1985-1986, **Visiting Scientist**, Institut fuer Festkoerperforschung der Kernforschungsanlage, Juelich, W. Germany.
1982, Theory Group at ORNL under my direction took award for **Best Sustained Research** in DOE competition.
1976-1977, **Visiting Professor**, Department of Physics, University of Bristol, England.
1968-1969, **Senior Fulbright Research Scholar**, Department of Physics, University of Sheffield, England.
1958-1959, **Dupont Postgraduate Research Fellow**.

Listed in: "Who's Who in America", "American Men and Women of Science", "Who's Who in the South and Southwest".

Professional Organizations: American Physical Society, **Fellow.** American Association for the Advancement of Science, **Fellow**. Materials Research Society. **ΣΞ**.

Professional activities: Associate Director, Center for Biological and Materials Physics. Served on Organizing Committees of 7 meetings.

Consulting contracts: Oak Ridge National Lab., 1993-
Los Alamos National Lab., 1987- 1990.

Publications: 86 refereed papers, 2 books, 2 chapters, 31 invited talks.
An novel based on real science, *The Sparrow*, 2012
A monograph on multiple scattering theory in preparation.

Curriculum Vitae

Armin Fuchs, Ph.D.

DOB: March 13, 1959 in Nuertingen, Germany

Citizenship: German, US permanent resident

Address:

Center for Complex Systems & Brain Sciences and Department of Physics
Florida Atlantic University
777 Glades Road
Boca Raton, FL 33431

Office: Behavioral Sciences, BS 12, room #307

Phone: 561-297-0125

FAX: 561-297-3634

Email: afuchs@fau.edu

Web: www.ccs.fau.edu/~fuchs

Employment:

2001-present: Associate Professor, Center for Complex Systems & Brain Sciences and Department of Physics, Florida Atlantic University, Boca Raton, FL

1995-2001: Assistant Professor, Center for Complex Systems & Brain Sciences and Department of Physics, Florida Atlantic University, Boca Raton, FL

1994-1995: Akademischer Rat (tenured staff), Institut fuer Theoretische Physik und Synergetik, Universitaet Stuttgart, Stuttgart, Germany

1993-1994: Postdoctoral fellow, funded by NIMH grant (MH42900, P.I.: J.A.S. Kelso), Center for Complex Systems, Florida Atlantic University, Boca Raton, FL

1991-1992: Individual postdoctoral fellowship, funded by DFG (German Research Foundation), Center for Complex Systems, Florida Atlantic University, Boca Raton, FL

1990-1991: Akademischer Rat (tenured staff), Institut fuer Theoretische Physik und Synergetik, Universitaet Stuttgart, Stuttgart, Germany

1985-1990: Wissenschaftlicher Angestellter (comparable: Research Assistant), Institut fuer Theoretische Physik und Synergetik, Universitaet Stuttgart, Stuttgart, Germany

Education:

Postdoctoral fellow, Center for Complex Systems, Florida Atlantic University, 1991-1994

Ph.D. (Theoretical Physics), Universitaet Stuttgart, Stuttgart, Germany, 1990

Diploma (Theoretical Physics), Universitaet Stuttgart, Stuttgart, Germany, 1985

Publications

Textbooks:

Armin Fuchs: Nonlinear Dynamics in Complex Systems: Theory and Applications for the Life-, Neuro- and Natural Sciences, Springer Verlag, Berlin (2013)

Edited Books:

Armin Fuchs, Viktor K. Jirsa, eds.: Coordination: Neural, Behavioral and Social Dynamics, Springer Verlag, Berlin (2008)

Recent Articles:

A. Fuchs, A. Hotiu, K.J. Jantzen, F. Steinberg, J.A.S. Kelso: `Diffusion Tensor Imaging in Mild Traumatic Brain Injuries - Acute State and Short-Term Recovery', Journal of Neurotrauma, revised version submitted

A. Fuchs: `Spatial Spectral Methods', in: Encyclopedia of Computational Neuroscience, D. Jaeger, R. Jung, eds., Springer Verlag, Berlin, to appear November 2014

M. Jing, T.M. McGinnity, S. Coleman, A. Fuchs, J.A.S. Kelso: `Longitudinal Study of Temporal Changes in Diffusion Patterns in Mild Traumatic Brain Injury Using Semi-Blind Source Separation', Journal of Biomedical and Health Informatics, accepted (2014), currently available under 'Early Access' on the journal's webpage

V. Murzin, A. Fuchs, J.A.S. Kelso: `Detection of Correlated Sources in EEG Using Combination of Beamforming and Surface Laplacian Methods', Journal of Neuroscience Methods, 218: 96-102 (2013)

V. Kostrubiec, P.G. Zanone, A. Fuchs, J.A.S. Kelso: `Beyond the blank slate: routes to learning new coordination patterns depend on the intrinsic dynamics of the learner - experimental evidence and theoretical model', Frontiers in Human Neuroscience, 6: 1-14 (2012)

M. Jing, T.M. McGinnity, S. Coleman, H. Zhang, A. Fuchs, J.A.S. Kelso: `Enhancement of fibre orientation distribution reconstruction in diffusion weighted imaging by single channel blind source separation', IEEE Transactions on Biomedical Engineering, 59: 363-373 (2012)

V. Murzin, A. Fuchs, J.A.S. Kelso: `Anatomically Constrained Minimum Variance Beamforming Applied to EEG', Experimental Brain Research, 214: 515-528 (2011)

A. Fuchs: `Dynamical systems in one and two dimensions: a geometrical approach', in: Nonlinear dynamics in human behavior, R. Huys, ed., Springer Verlag, Berlin, pp. 1-34 (2010)

A. Fuchs, J.A.S. Kelso: `Movement Coordination', in: Encyclopedia of Complexity and Systems Science, B. Meyers, ed. in chief, Springer Verlag, Berlin, pp. 5718-5736 (2009)

Robert Gross

501 Dotterel Road; 25 D
Delray Beach, FL 33344

Education:

B.S., Physics, University of Rhode Island	1997
Ph. D, Physics, Florida Atlantic University	2002

University Teaching Positions:

Adjunct Professor, Florida Atlantic University	2003-2007
Instructor, Florida Atlantic University	2007 - Present

Courses Taught:

PHY 2053 - College Physics I
PHY 2054 - College Physics II
PHY 2044 – Engineering Physics II
PHY 2048 – General Physics I
PHY 2049 – General Physics II
PHY 2048 – Honors General Physics I
PHY 2049 – Honors General Physics II
PHZ 3113 – Mathematical Methods for Physicists
AST 2002 - Astronomy
PSC 2121 – Physical Science
PHY 4936 – Applications of Mathematica in Science (designed course as well)
MCAT Preparation Course – Physics Portion

Related Work Experience:

Teacher, Yeshiva High School	2001-2002
Taught Honors Physics and AP Physics	
Tutor, Score at the Top Learning Center	2001-2003
Math and Physics Tutor	
Tutor, Florida Atlantic University- Oxley Athletic Center	2000-2006
Math and Physics Tutor for Student Athletes	
Tutor, Florida Atlantic University- Multicultural Center	2004-2006
Math and Physics Tutor	

University Services:

Florida Atlantic University Science Olympiad	2009; 2011-2014
Judge and coordinator for Sounds of Music	
Florida Atlantic University; Physics Pumpkin Drop	2008-2014
Helped coordinate event	
Florida Atlantic University; Astronomy Dome 100 Hour Marathon	2010

Ran a four session of the telescope
Florida Atlantic University; Math Day 2011
Ran a physics demonstration table

Research Interests:

Analysis of nonlinear systems.
Sports physics.

ANGELICA HOTIU

Florida Atlantic University
Charles E. Schmidt College of Science,
Department of Physics
777 Glades Road, Boca Raton,
FL, 33431
Phone: 561-297-3380
ahotiu@fau.edu

EDUCATION

- **PhD** Physics, May 2010, Florida Atlantic University, Boca Raton, FL
  Dissertation: Diffusion Tensor Imaging in Mild Traumatic Brain Injuries
  Advisor: Dr. Armin Fuchs, PhD
- **MS** Physics, December 2006, Florida Atlantic University, Boca Raton, FL
  Master Thesis: The Relationship between Item Difficulty and Discrimination Indices in Multiple-Choice Tests in a Physical Science Course
  Advisor: Dr. Robin Jordan, PhD
- **BS** Physics, July 1993, Babes-Bolyai University, Cluj-Napoca, Romania

PROFESSIONAL EMPLOYMENT

2010-2013 Adjunct Instructor, Department of Physics, Florida Atlantic University
2013-Present Visiting Instructor, Department of Physics, Florida Atlantic University

TEACHING EXPERIENCE

05/10 - present Florida Atlantic University, Department of Physics

- Courses taught: General Physics I PHY2048
  General Physics II PHY2049
  College Physics II PHY2054
  Thermodynamics PHY3053
  Physical Science PSC2121 (on campus and online)
  Statistical Mechanics PHY4523
- Physics Lab taught: PHY2048L, PHY2049 L
- Develop online Physical Science PSC2121 course in Blackboard
- Experience using LMS (Blackboard, eCollege, Canvas)
- Experience using online teaching tools to enhance students' learning experience: StudyMate, Top Hat Monocle, Screencasting, Wiggio, Talkboard, etc,…

PUBLICATIONS

"Diffusion Tensor Imaging in Mild Traumatic Brain Injuries" A. Hotiu, A. Fuchs –submitted for NeuroImage Journal.
"Effect of Simulated Body Fluid on the Microstructure of Ferrimagnetic Bioglass Ceramics." N. Papanearchou, Th.Leventouri A. C. Kis, A. Hotiu, and J. M. Anderson, Mat. Res. Soc. Symp. Proc. **839**, P3.7.1, 2005

CERTIFICATIONS

- eLearning Designer/Facilitator Certification for developing online courses

ORAL/ POSTER PRESENTATIONS

- FLORIDA ACADEMY OF SCIENCES - Annual Meeting
  "Quantification of multiple-choice test items" – Oral Presentation
  University of South Florida, Florida, March 2007 by Angelica Hotiu and Robin Jordan
- COORDINATION DYNAMICS, 2007 – Boca Raton, Fl, USA- participation
- GRADUATE RESEARCH DAY at FAU - March 2009
  "Diffusion Tensor Imaging in Mild Traumatic Brain Injuries"- Poster Presentation
  by Angelica Hotiu and Armin Fuchs
- SOCIETY FOR NEUROSCIENCE ANNUAL MEETING, 2009 – Chicago, USA
  "Sequential diffusion tensor imaging reveals temporal changes in white matter tracts during recovery from mild traumatic brain injuries" - Poster Presentation
  by Armin Fuchs, Angelica Hotiu, Kelly J. Jantzen and J.A. Scott Kelso

WORKSHOP

- TEACHING WORKSHOP: "How to be a more effective teacher" Charles E Schmidt College of Science, August 20, 2010
- TEACHING WITH TECHNOLOGY SHOWCASE, FAU, October 1, 2011
- TRAINING WEBINAR-Teaching Technical Courses Using Blackboard Collaborate, FAU, March 30, 2012
- TRAINING WEBINAR-STUDYMATE AUTHOR: Creating Learning Activities, April 3, 2012
- TRAINING WEBINAR-Smarthinking, September 28, 2012,
- TRAINING WEBINAR- Effective Strategies To Help Faculty Achieve New Semester Goals & Improve Their Teaching, April 4, 2014
- TRAINING WEBINAR - Smarthinking Overview, August 13, 2014
- TRAINING WEBINAR- Getting Started with WileyPlus, August 13, 2014

SCIENCE OLYMPIAD

- Event Supervisor for Thermodynamics and Keep the Heat - 2013
- Event Supervisor for Simple and Compound Machines (B and C event) - 2014
- Event Supervisor for Simple Machines (Elementary) - 2014

PROFESSIONAL AFILIATIONS

2005 – Present American Physical Society (APS)
2011 –Present Physics Teacher Education Coalition

Dr. ROBIN G. JORDAN

EDUCATION:

B.Sc Physics 1963 University of Sheffield, England. Ph.D Physics 1967 University of Sheffield, England.

EMPLOYMENT:

Professor of Physics (November 1989-August 2009) co-Director Alloy Research Center, (1989-1998)
Florida Atlantic University, 777 Glades Road, Boca Raton, Florida 33431-0991.
Office:
(561)297-3380
FAX: (561)297-2662

HONORS and AWARDS:

1994 "**Distinguished Teacher of the Year 1993-1994**" - Florida Atlantic University.
1998 "**Researcher of the Year**" - Florida Atlantic University.
1998 "**Professorial Excellence Program (PEP) Award**" - Florida Atlantic University.
1999 "**Award for Excellence in Undergraduate Teaching**" - Florida Atlantic University.
2002-2009 "**Master Teacher**", Charles E. Schmidt College of Science - Florida Atlantic University. 2009 "**Emeritus Professor**", Charles E. Schmidt College of Science - Florida Atlantic University.

RECENT RESEARCH GRANTS:

R.G. Jordan and S.L. Qiu (9/1/92 - 8/31/95) "Electronic Structure and Properties of Metallic Alloys" NSF $231,900.

R.G. Jordan et al (8/1/96 - 7/31/99) "Acquisition of High-Performance Graphics Supercomputer for the College of Science,
FAU" NSF (Academic Research Infrastructure (ARI) Program) $249,099

R.G. Jordan and S.L. Qiu (9/1/95 - 5/31/99) "Electronic Structure and Properties of Metallic Alloys" NSF $222,300.

J. Haky, R.G. Jordan, D. M. Baronas-Lowell and W.R. Brooks (1/10/02 - 30/9/04) “Success by Design: Building Faculty Capacity to Improve Curriculum and Instruction” NSF-CCLI (DUE-0126969) $74,999.

RECENT PAPERS (¶ invited):

¶ "Photoemission: a probe of the electronic structure in metals and alloys" R.G. Jordan, S.S. Cang, A.T. Dorsey, L.R. Masliah, S.L. Qiu and Xumou Xu, *J. Phase Equilibria* **18**, 663 (1997).

"Core level shifts and density of states at the (100) surface of Cu_3Au" R.G. Jordan and G.Y. Guo, *Solid St. Commun*. **105**, 125 (1998).

¶ "Some properties of Cu-Au alloy surfaces" R.G. Jordan, *J. Phase Equilibria* **19**, 517 (1998).

“Surface core level shifts and the termination at the (001) surface of equiatomic CuAuI” R.G. Jordan, W. Munoz and E.A. Raley, *Phys. Lett* **A264**, 489 (2000).

“Playing around with Achromatic Pairs” R.G. Jordan, *The Physics Teacher* **39**, 102 (2001).

“Work-reworked” R.G. Jordan, *The Physics Teacher* **40**, 27 (2002).

RECENT CONFERENCE PAPERS:

“Some new (and not so new) ideas about teaching science” 11th **INTERNATIONAL CONFERENCE on COLLEGE TEACHING and LEARNING**, Jacksonville, FL April 2000.

“Using an electronic response system in the classroom” 15th **INTERNATIONAL CONFERENCE on COLLEGE TEACHING and LEARNING**, Jacksonville, FL April 2004 (with J.E. Haky and D.W. Louda).

“Measuring Static and Kinetic Friction on an Inclined Plane via Remote Labs Modality” B. Alhalabi, R.G. Jordan, Ali Abu-El
Humos, M.K. Hamza, at the **9th WORLD MULTI-CONFERENCE ON SYSTEMATICS, CYBERNETICS AND INFORMATICS**, Orlando, Florida, July 10-13, 2005.

“Incorporating Active Learning into Courses and Programs: A Scholarly Dialogue”, R.G. Jordan (FAU), A. Bruce (University of Massachusetts, Lowell), D. Laverie (Texas Tech), D. Runshe (Indiana State), M. Wicker (Clayton College), at the
INSTITUTE FOR HIGHER EUCATION POLICY 2005 SUMMER ACADEMY, Snowbird, Utah, July 13-17, 2005.

“What did George Simon Ohm *really* discover?” R.G. Jordan, **FLORIDA ACADEMY OF SCIENCES** - Annual meeting, Florida Institute of Technology, March 2006.

“Examples of questions that test students' understanding of the concepts of electrostatics”, R.G. Jordan, **FLORIDA ACADEMY OF SCIENCES** - Annual meeting, Florida Institute of Technology, March 10-11, 2006.

"Quantification of multiple-choice test items", Angelica Hotiu and Robin Jordan, **FLORIDA ACADEMY OF SCIENCES** - Annual meeting, Florida Institute of Technology, March 10-11, 2007.

"Relationship between attendance and student performance in introductory physics courses", Robin Jordan, Rebekka Epps and Roger Leff, **FLORIDA ACADEMY OF SCIENCES and the GEORGIA ACADEMY OF SCIENCES** - Annual meeting, Jacksonville University, March 14-15, 2008.

"Does homework improve student performance in introductory science courses?", Rebekka Epps, Robin Jordan and Roger
Leff, **FLORIDA ACADEMY OF SCIENCES and the GEORGIA ACADEMY OF SCIENCES** - Annual meeting, Jacksonville University, March 14-15, 2008.

TEACHING AND LEARNING WORKSHOPS PRESENTED:

August 2004 "How to teach effectively" - two day workshop for faculty on (i) your students, (ii) teaching styles, (iii) writing a syllabus, (iv) designing a course web-site, (v) use of other technologies, and (vi) test writing tips.

July 2005 Co-chaired (with D. Laverie, Texas Tech) a roundtable on "Using Personal Response Systems to Enhance Active Learning" at the **INSTITUTE FOR HIGHER EUCATION POLICY 2005 SUMMER ACADEMY**, Snowbird, Utah.

August 2005 "How to be a more effective teacher" - one day workshop for faculty on (i) meet your students, (ii) improving your teaching technique, (iii) more tips on teaching and writing a syllabus, (iv) websites and other technologies.

August 2006: "How to be a more effective teacher" - one day workshop for faculty on (i) meet your students, (ii) improving your teaching technique, (iii) Blackboard, classroom response systems and other technologies, (iv) more tips on teaching and writing a syllabus.

August 2007: "How to be a more effective teacher" - one day workshop for faculty on (i) meet your students, (ii) improving your teaching technique, (iii) Blackboard, classroom response systems and other technologies, (iv) more tips on teaching and writing a syllabus.

October 2007: "Teaching and Learning" - evening workshop for FAU Teaching Assistants.

August 2008: "How to be a more effective teacher" - one day workshop for faculty on (i) meet your students, (ii) improving your teaching technique, (iii) writing a syllabus, Blackboard and electronic response systems, (iv) more tips on teaching and classroom management.

Georgios Kalantzis
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Tell: 832-643-6538

EDUCATION

UNIVERSITY OF TEXAS-MD ANDERSON
2004-2009 Ph.D. in Computational Neuroscience-Biophysics

UNIVERSITY OF ATHENS-GREECE
2003-2004
M.S. in Computer Science

GREEK COMMISSION OF ATOMIC ENERGY
2000-2003 M.S. in Medical and Radiation Physics
Completed 1 year clinical residency at the Areteion Hospital-University of Athens

UNIVERSITY OF ATHENS-GREECE
1995-2000 B.S. in Physics

POSTDOCTORAL TRAINING

MEMORIAL SLOAN KETTERING CANCER CENTER
2012-2013
Postdoctoral Fellow in Medical Physics-Radiation Therapy

STANFORD UNIVERSITY
2011-2012

Postdoctoral Associate in Medical Physics-Radiation Therapy

UNIVERSITY OF TEXAS-HSCSA
2010-2011
Resident in Medical Physics-Radiation Therapy

RESEARCH EXPERIENCE

1. Numerical parallelization methods
2. Experimental investigations of various modalities for radiation therapy treatment
3. Optimization methods
4. Application of pattern recognition methods
5. Application of machine learning methods and evolutionary algorithms
6. Monte Carlo methods
7. Stochastic biophysical modeling

8. GPU computing
9. Numerical methods: Sensitivity analysis, bifurcation analysis, numerical analysis, scientific programming

HONORS AWARDS

- Top student upon exams to attend the Inter-University Postgraduate Program of Medical and Radiation Physics. 2000
- Travel Grants (UT-MD ANDERSON)
  2004-2009
- Travel Award Computational Neuroscience Society
  2004-2009
- Award from Onaseio Foundation $24,000 for outstanding Greek students studying abroad
  2006-2008

PROGRAMMING SKILLS

C++, CUDA, OpenMP, MPI, Matlab.

ACADEMIC SERVICES AND SEMINAR ORGANIZATIONS

Organizer of the weekly Journal Club among UT, Rice, Baylor and UH
2005-2007

SUMMER SCHOOLS SEMINARS

- Nonlinear Systems (U. of Patra, Dept. of Mathematics, Greece)
  2002 Experimental and Computational Neurodynamics (UCSD, Dept. of Mathematics and Physics) 2004
- Theory and Application of Stochastic Processes (Rice University, Dept. of Applied Mathematics)
  2006
- Computational Neuroscience (Okinawa Institute of Science and Technology)
  2008
- Statistical Methods in Genetics (Rockefeller University)
  2009

INVITED TALKS

AAPM Southwest Chapter Meeting in Dallas. "IMRT 2D dose modeling using artificial neural networks"
2011

PEER REVIEWED PUBLICATIONS

1. **G. Kalantzis,** Y. Lei, “A self-tuned bat algorithm for IMRT optimization” (Accepted SNPD 2014)
2. **G. Kalantzis,** A. Apte, “A novel reduced-order prioritized optimization method for radiation therapy treatment planning” (IEEE Trans. Biom. Eng. 2013, (4):1062-70)
3. **G. Kalantzis,** A. Apte, R. Radke, A. Jackson. “A reduced order memetic algorithm for constraint optimization in radiation therapy treatment planning” (IEEE , SNPD 2013:225-230)
4. **G. Kalantzis**, T. Lo, D. Hristov, S. Dieterich. “Comparison of peripheral dose between fixed cone and IRIS planning for intracranial SRS with a VIS CyberKnife”, (under revision 2013)
5. **G. Kalantzis**, Qian J, B. Han, G. Luxton. “Investigations of fidelity of dose delivery at high dose rate of flattening filter free (FFF) beams in rapidarc of TrueBeam”, (J Med Phys 2012, 37(4):193-9)
6. **G. Kalantzis**, H. H. Tachibana. “Accelerated event-by-event Monte Carlo simulations of low energy electron and proton tracks on a CUDA-enabled GPU” (Comp. Methods Prog. Biomed. 2013,(113):116-25)
7. **G. Kalantzis**, D. Emfietzoglou and P. Hadjidoukas. “A unified spatio-temporal parallelization framework for accelerated Monte
   Carlo radiobiological modeling of electron tracks and subsequent radiation chemistry” (Comp.Phys. Comm. 2012,183(8):168695)
8. **G. Kalantzis**, L. Vasquez, T. Zalman, Y. Lei. “Towards IMRT 2D dose modeling using artificial neural networks: A feasibility study” (Med. Phys. 2011,(10):5807-17)
9. **G. Kalantzis**. “Hybrid stochastic simulations of intracellular reaction-diffusion systems” (Comp. Biol. & Chem. 2009,33(3):20515)
10. **G. Kalantzis** and H. Shouval. “Structural plasticity can produce metaplasticity”. (PLOS One 2009.4(11):e8062)
11. **G. Kalantzis**, Y. Kubota and H. Shouval. “Simulations and analysis for evaluating statistical methods that are used to estimate the number of postsynaptic receptors”. (J. Neurosci. Methods 2009,178(2):393-401)
12. H. Shouval and **G. Kalantzis**. “Stochastic properties of synaptic transmission affect the shape of spike time dependent curves”. (J. Neurophysiol. 2004,93(2):1069-73)

SCIENTIFIC ABSTRACTS

1. **G. Kalantzis,** L. Rivera, R. Radke, A. Apte, A. Jackson. “Reduced order prioritized optimization for IMRT treatment planning” (Annual AAPM 2013)
2. **G. Kalantzis**, T. Lo, S. Dieterich. “Evaluation of peripheral dose for SRS treatment radiations with the VIS CyberKnife: A phantom study”, Annual AAPM 2012
3. **G. Kalantzis**, J. Qian, B. Han , G. Luxton. “Investigations of fidelity of dose delivery at high dose rate of flattening filter free (FFF) beams in rapidarc of TrueBeam”, Annual AAPM 2012
4. **G. Kalantzis**, H. H. Tachibana, Y. Lei. “Accelerated event-by-event Monte Carlo simulations of low energy electron and proton tracks on a CUDA-enabled GPU”, Annual AAPM 2012
5. **G. Kalantzis**, O. Calvo, C. Sath, S. Stathakis, N. Papanikolaou. “Effect of multileaf collimator width on dynamics conformal arc: a planning study”. EMPEC 2011
6. **G. Kalantzis**, Y. Lei, N. Papanikolaou. “EPID-based Winston-Lutz using a circular Hough transformation”. Annual AAPM 2011
7. **G. Kalantzis** and H. Shouval. “Morphological plasticity induces synaptic metaplasticity”. Society for Neurosceince 2008

8. **G. Kalantzis**, Y. Kubota and H. Shouval. “Modeling stochastic calcium dynamics in the dendritic spines: A hybrid approach”. Computational Neuroscience Society 2008
9. **G. Kalantzis** and H. Shouval. “Spatiotemporal molecular dynamics and synaptic plasticity”. Computational Neuroscience Society 2008
10. **G. Kalantzis**, N. Aslam and H. Shouval. “Spatiotemporal dynamics of calcium and calmodulin at the spine”. Computational Neuroscience Society 2007
11. Y. Kubota, **G. Kalantzis**, J. A. Putkey, H. Shouval and M. N. Waxham. “Coarse Bifurcation analysis and model reduction of the computer simulation of the postsynaptic CaMKII signaling system”. Biophysical Society 2005
12. **G. Kalantzis**, Y. Kubota and H. Shouval. “Estimating the number of postsynaptic NMDA receptors in the spine head”. Computational Neuroscience Society 2005

Abbreviated CV

Grigoriy Kreymerman
gkreymer@fau.edu

EDUCATION:

Ph.D. Physics (1989), Thermo-physics Department at Academy of Sciences, former Soviet Union

B.S. Physics (1976), Tashkent State University, former Soviet Union

Research Associate Professor, Department of Physics, Florida Atlantic University, Boca Raton, FL, August 2007 – Present.
Courses taught and developed:

- Undergraduate course Physics for Engineers 1 PHY 2043
- Undergraduate course Physics for Engineers 2 PHY 2044
- Undergraduate course General Physics 2 PHY 2049
- Special topic of Experimental Optics (Undergraduate research) upper level course PHY 4936

- Directed Independent Study (Undergraduate research) upper level course PHY 4905

Research:

- Conducted research in collaboration with CREOL at UCF on volume holographic gratings as quantum gates for quantum information processing. Applied as Co-Pi for NSF grant in Quantum Inform.on Science.
- Supervised research of undergraduate students on Laser Tweezers and Raman Spectroscopy in optical laboratory. The results of research were presented on undergraduate research symposiums.
- Consulted in the field of the biometric-based technology for ultrasound fingerprint identification for Ultra-Scan Corporation, Amherst, NY, 2006-2008

Senior Research Scientist, NASA Imaging Technology Center, Florida Atlantic University, Boca Raton, FL, September 1996– August 2007

- Advised graduate students in the areas of photonics and opto-electronics.
- Conducted research on an active matrix diffractive liquid crystal laser projection display.
- Invented an Adjustable Opto-Acoustical Low-Pass Filter for HD video cameras and still imaging cameras.
- Conducted research and development of high-resolution (100µkm) wireless ultrasound scanner for diagnostics in medical application.
- Invented Fiber Optic Flat Panel Liquid Crystal Display.

Group Leader, Division of Applied Optics, Thermo-physics Department, Academy of Sciences, former Soviet Union, April 1981 – Feb. 1991

- Taught graduate course Optoelectronics. Advised graduate students.
- Conducted research on interactions of acoustic waves and alternating electric fields with optical radiation in fiber optics.

- Developed fiber optic laser devices for medical applications.
- Conducted research in advanced fiber optic communication systems utilizing direct modulation of the signal polarization in single mode fibers.
  Designed fiber optic sensors; hydrophone, accelerometer, sensor of electric/magnetic fields.

Research Scientist, Laboratory of Physical Electronics, Tashkent State University, former Soviet Union, Sept. 1976 - April 1981.

- Supervised seminar and taught laboratory on Vacuum Electronic Devices.
- Conducted research on charged ions ejected from mono and polycrystalline metals by ions of rare-earth metals using streamlined Mass Spectrometers and Energy Spectrum analyzers.

Department & University Service:

- Managed undergraduate research in optical laboratory.
- Member supervisory committee for Ph.D. students.
- Supervised the optics section University Regional South Florida Science Olympiad for middle and high schools students.

Professional Service:

- Referee for Journal Optical Engineering
- Referee for Journal of the Optical Society of America A

Most Resent Publications and Patents:

1. **G.Kreymerman,** "Adjustable active optical low pass filter", Applied Optics, Vol. 51, No. 2, pp 268-272, January 2012
2. W. A. Miller, P. M. Alsing, **G. Kreymerman**, J. R. McDonald, C. C. Tison, "Quantum computing in a piece of glass" SPIE Defense Security and Sensing, Proc. of SPIE Vol. 8057, Session 4: Quantum Algoritms, Orlando, April 2011
3. **G. Kreymerman**, "Application theory of scattering and coupled mode analysis for liquid crystal diffractive grating", Optics Express, Vol.18, issue 15, pp 15513-15522 (2010)
4. **G. Kreymerman**, "Liquid Crystal Diffractive Phase Grating as Light Modulator for Projection Display", Journal of Optical Engineering, Vol. 45, No. 11, p. 116202-1116202-7, November 2006

Patents:

5. W. A. Miller, P. M. Alsing, **G. Kreymerman** Method and Apparatus For Quantum Holographic Information Processing, Patent Application Publication Number: US 2014/0192388 A1, July 10, 2014
6. **G. Kreymerman,** Fiber Optic Flat Panel Liquid Crystal Display. Patent No.: US 6,621,549, Sep. 16,2003
7. **G. Kreymerman,** Adjustable Opto-Acoustical Low Pass Filter and Technique. Patent No.: US 6,356,379. Mar. 12, 2002 .

Andy W.C. Lau

Associate Professor of Physics

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Phone: (561) 206-2128; (561) 297-3380 (O); Fax: (561) 297-2662
Email: alau@physics.fau.edu; Webpage: http://www.physics.fau.edu/ alau/

Education

University of California, Davis	Physics	B.S.	1994
University of California, Santa Barbara	Physics	M.A.	1998
University of California, Santa Barbara	Physics	Ph.D.	2000

Employment

2010– Present Associate Professor, Florida Atlantic University 2005
– 2010 Assistant Professor, Florida Atlantic University
9/01 – 12/05 Postdoctoral Fellow, University of Pennsylvania
11/00 – 8/01 Postdoctoral Fellow, College de France, Paris, France
1994– 2000 Research Assistant, University of California, Santa Barbara
06/95 – 09/95 Graduate Student Researcher, Los Alamos National Laboratory
03/93 – 06/93 Undergraduate Student Researcher, Los Alamos National Laboratory

Honors

- **College of Science nominee for Researcher of the Year Award**, FAU (2008).
- **Chaire Joliot visiting professorship**, E.S.P.C.I., Paris, France (2006).
- **John Cardy Award**: For excellent academic performance and evidence of future promise in physics, University of California, Santa Barbara (1995).
- **Saxon-Patten Prize in Physics**: For achieving an excellent academic record and showing interest and promise in continued work in physics and/or related physical sciences, University of California, Davis (1994).
- **Department Citation**: For excellence in the major program and outstanding GPA in courses given by the department major program, University of California, Davis (1994).

Professional Organizations

- Member, American Physical Society.

FAU FLORIDA ATLANTIC UNIVERSITY

Dr. Th. Leventouri
Professor of Physics
Director, Center for Biomedical and Materials Physics (CBAMP)
Director, Medical Physics Program
Department of Physics
Charles E. Schmidt College of Science

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BRIEF CV
Theodora Leventouri

EDUCATION

- Ph.D. Physics, Experimental Condensed Matter Physics, University of Athens, Greece.
- Post Graduate Training: Visiting Research Scientist 1983-84, X-Rays and Applications Group, Oak Ridge National Laboratory (ORNL), USA.
  Visiting Research Scientist 1998, High Flux Isotope Reactor, Neutron Scattering Section, Solid State Division, ORNL, USA.

ACADEMIC APPOINTMENTS

- 2006-present: Professor, Physics Department, FAU.
- 2010-present: Founding Director, Medical Physics program, FAU.
- 2006-present: Director, Center for Biomedical and Materials Physics (CBAMP).
- 1992-2006: Associate Professor, Physics Department, FAU.
- 1986-92: Associate Professor, Physics Department, Solid State Section University of Athens, Greece.
- 1988-91: Associate Scholar Scientist, Physics Department, FAU.
- 1986-92: Associate Professor, Physics Department, University of Athens, Greece.
- 1982-86: Lecturer, Physics Department, University of Athens, Greece.
- 1973-82: Assistant Professor, Physics Department, University of Athens, Greece.

RESEARCH FIELD

Structure related physical properties of crystalline matter using x-ray diffraction, neutron scattering and electron microscopy. Current studies: apatite based natural, synthetic, and nanoscale magnetic materials for biomedical applications.

COURSES TAUGHT/NEW COURSES

PHY 3221, PHY 4822L, PHS 5224, PHS 5204, PHY 5937, PHY 6938, PHY 6971, PHZ 6435, PHY 6920, PHY 2053, PHY 2054, PHY 3051, PHY 3050, PHY 3040, PHY 7980, PHZ 5304, RAT 6686, RAT 6975, RAT 6687, PHY 6920 RAT 6932 NEW: PHY 5937 "Intro Nanomaterials", PHY 6938, PHZ 6435 "Modern X-ray Powder Diffraction"

NEW PROGRAM FOUNDED

Professional Science Master in Medical Physics: 2010, CAMPEP Accredited 2014

ADVISOR

Ph.D. Physics: 8 (currently 5), MS Physics: 5, MS Medical Physics: 13 (currently: 5).

REVIEWER

NSF, PRB, PRL, Biomaterials, J Pharmaceutical and Biomedical Analysis, Materials Research Society Proceedings, Crystal Growth & Design, Journal of Solid State Chemistry, Acta Biomaterialia, Thermochemica Acta, J Surface Coatings and Technology, J Biomedical Materials Research. Part A, J. American Mineralogist.

PUBLICATIONS (2006- , TOTAL 68)

- *Surface Dose Evaluation Outside Treatment Area for Breast Cancer Irradiation Modalities Using TLDs*, Suraj P. Khanal, Zoubir Ouhib, Rashmi K. Benda, Th. Leventouri, journal of Brachytherapy, submitted.

- *Output factor measurements and corrections in small photon fields*, Bacala, Angelina; Smith, Cindy; Pella, Silvia; Leventouri, Theodora. Article reference: PMB-101214, Physics in Medicine and Biology
- *Combined x-ray and neutron diffraction Rietveld refinement in iron substituted nano-hydroxyapatite* A. Kyriacou, Th. Leventouri, B. C. Chakoumakos, V. O. Garlea, C. B. dela Cruz, A. J. Rondinone, K. D. Sorge, J Mater Sci (2013) **48**:3535–3545, DOI 10.1007/s10853-013-7148-5.
- *Elastic Properties of UHMWPE-SWCNT Nanocomposites' Fiber: An Experimental, Theoretic, and Molecular Dynamics Evaluation*, Mujibur R. Khan, Hassan Mahfuz, Ashfaq Adnan, Ishraq Shabib, Theodora Leventouri, J. Materials Engineering and Performance, 08/2013; 22(6). DOI:10.1007/s11665-013-0471-9.
- *Effect of strain hardening on the elastic properties and normalized velocity of hybrid UHMWPE–nylon 6–SWCNT nanocomposites fiber*, M. R. Khan, H. Mahfuz, Th. Leventouri. J. Mat. Res. **27**, 2657-2667 (2012). doi:10.1557/jmr.2012.155
- *Investigation of MWCNT reinforcement on the strain hardening behavior of Ultra High Molecular Weight Polyethylene (UHMWPE)*, H. Mahfuz, M. R. Khan, Th. Leventouri, E. Liarokapis, J. Nanotechnology 2011, JNT/637395 doi: 10.1155/2011/637395.
- *Enhancing toughness of LDPE filaments through infusion of MWCNTs and UHMWPE* M. R. Khan, H. Mahfuz, Th. Leventouri, V. K. Rangari and A. Kyriacou, J. Polymer Engineering and Science 2010/DOI: 10.1002/pen.21873.
- *Crystal structure studies of human dental apatite as a function of age* Th. Leventouri, A. Antonakos, A. Kyriacou, R. Venturelli, E. Liarokapis, V. Perdikatsis, Intern. J. Biomat. Vol. 2009 (2009), ID 698547.
- *Magnetic properties of Fe-Co catalyst particles in vertically aligned carbon nanofibers* K. D. Sorge, K. L. Klein, A. V. Melechko, C. L. Finkel, O. Malkina, Th. Leventouri, J. D. Fowlkes, P. D. Rack, and M. L. Simpson. J. Appl. Phys., **104**, 033909 1-7 (2008).
- *"Micro-Raman and FTIR Studies of Synthetic and Natural Apatites"*, A. Antonakos, E. Liarokapis, Th. Leventouri. J. Biomat. **28**, 3043-3054 (2007).
- *Synthetic and Biological Hydroxyapatites: Crystal Structure Questions "*, Th. Leventouri, J. Biomat. **27**, 3339-3342, (2006). (Leading Opinion Paper, invited).
- Book Chapter: *"Structure Studies of Hydroxyapatite-based Biomaterials"*, Th. Leventouri, invited by Nova Science Publishers Inc. in Biomaterials Research Advances Editor: Jason B. Kendall ISBN-1-978-1-60021-892-7 (2007).

PROFESSIONAL ORGANIZATIONS (Member)

- American Physical Society, Hellenic Physical Society, American Crystallographic Association, Materials Research Society, American Association of Physicists in Medicine, Society of Directors of Academic Medical Physics Programs, American Association of University Women

CURRENT GRANTS

- 2014-2015 *Synthesis, crystal structure and mechanical properties of Hydroxyapatite.* Oak Ridge National Laboratory (ORNL, Center for Nanoscale Materials Science, User Grant $30K
- 2015 FAU Technology Fee: Medical Physics Lab III $23K
- 2013-2014 *Synthesis and crystal structure studies of substituted nano Hydroxyapatites.* (ORNL), User Grant $30K

CONFERENCES

10 Invited, 43 presentations, 20 regional **COLLOQUIA** 20 Invited

Leonardo Martinez Z Nov 12 -2014
Physics Department
561 705 8863

EDUCATION
Master in Science State University of New York at Albany 1971
BS in Education Physics and Mathematics Universidad Pedagogica de Colombia, Bogota.

To further my education, while doing research and teaching at the University of Los Andes in Merida, Venezuela, I took several courses related to my field of research. These courses include: X-Rays, Sputtering, Superconductivity , Physics of Quantum Wells , and Optical Properties of Semiconductors, Electron and Atomic Force Microscope.
I participated in the eLearning Designer/Facilitator Certification course offered also at FAU and in several Faculty Learning Community (FLC) "Teaching Online Courses for Creativity and Critical Thinking"

Teaching Experience.
Instructor in the Physics Department at FAU since 1997.
Visiting Research and Teaching Instructor in the Physics Department at FAU 1986-1987
Associate professor of Physics Department of Physics Universidad de los Andes in Merida Venezuela 1972-1992.
Assistant Professor of Physics Universidad Pedagogica , Colombia, Bogota. 1971-1992
In the past few semesters, I have been working in the design and implementation of a distance learning Currently I am teaching three astronomy courses, two face-to-face sections and a fully online DisL section. In addition I am overseeing two different Physics lab sections.

Research.
My research efforts have been concentrated in the field of optical properties of chalcopyrite Ternary Semiconductors and binary semiconductors, using the experimental techniques of Raman Spectroscopy, Optical absorption, Photoluminescence and Electron and atomic force microscopy.
I worked in Dr. Fernando Medina's laboratory and acted as co-adviser of some of his graduate students.
As a visitor scholar at FAU in 1988 1989 I was involved with the preparation and characterization of High Tc superconductors.
As a visitor scholar at the University of Iowa, had the opportunity to learn to important research tools; atomic force and electron microscopes. I used these instruments to study the structural properties of the Zn(1-x)Mn(x)In2Se2 semi magnetic semiconductor and gold particles immersed in SiO.

Publications:
1- N.V Joshi, L. Martinez, R Echeverria. An experimental Investigation of the Photoconductivity Spectrum of the Monocrystal AgInS(2) : Grown by Bridgman and Chemical Transport . Chem. Solids Vol. 42, pp, 281-185 (1981)
2- L. Martinez, A. Lopez-Rivera, V. Sagredo . Preparation and properties of AgInS- AgInSe: Single Crystal of the Quaternary Alloys AgInSe21-x)S2x. Il Nuovo Cimento Vol 2D, N6, 1687 1983).
3- E. Liarokapis; L.T Willie; Th. Leventouri, L. Martinez, H. Lu, V. Hadjievv and M. Iliev. Raman Study of the Structural Properties of YBa2Cu(1-x)Fex):Oy. Physica C 170, 419-426 (1990)
4- Th. Leventouri, E. Liarokapis; L. Martinez; F. Medina;M. Moreno; B.D. Landreth;W.J. Wallace and R. Clark. Study of Y-Ba_Cu_O Superconductors Prepared with the Oxalate Precipitation/evaporation method . Modern 15-PYS. Physics Letters B4N_19 1237-1224 (1990)

5- Hascicek, L. Testardi, Th. Leventouri, E. Liarokapis; L. Martinez. Transport Critical Currents density of partially alined Bulk Samples of YBa2CuO7-x . Journal of Applied Physics 68, 4178 (1990)
6- L. Martinez, L.R. Gonzalez and W. Giriat. Optical Absorption Studies in Zn(1-x)MnxSe. Phys. Status Solidi b 180, 2678 1993).
10- L. Martinez, S.A. Lopez_Rivera, W. Giriat and F. Medina. Nature of Absorption Bands in Zn(1-x)C0xS. J. of Crysatal Growth 138, 913 91994)
7- S. A LopezIRivera, L, Martinez, B. Fontal, W. Giriat, F. Medina. Raman Study of ZnIn2S4 compound Semiconductor. Semicond. Sci. Technol. 10, 645 (1995)
8- L. Martinez, J.M. Briceno, S.A. Lopez_Rivera, K Moore and J. T. Thorton. Micropattern Analysis of ZnIn2S4 Using Atomic Force Microscope (AFM) and Transmission Electron Microscope (TEM). Proc. Microscopy and Microanalysis. 1995dited by G.W Baily M. HEllison, R.A Henigar and J. Zalazec
9- S.A Lopez-Rivera, L. Martinez, W, Giriat, J.M. Briceno, J. Xue, Y.Ye and F. Medina, The luminescence Center of the Zn(1-x)Mn(x) Se Single Crystal . 11 th Conference on Ternary and Multinary Compounds ICTMC-11 (1997)
10- Yoon, Chang-Sun; Medina, F.D; Martinez, L.; Park, Tae-Young,; Jin, Moon-Seg; Kim, Wha-Tek. Blue photoluminescence of α-Ga2S3 and α-Ga2S3:Fe2+ single crystals. Applied Physics Letters, Vol 83, 10, 1947 ,2003.
11- A. Swetii, L. Martinez, F. Medina and A. Lopez. Near band Edge Luminescence Spectroscopy of Cd (x)Zn(1-x)Se. Sem. Science and Tech, 23, 3, 2008

Books.

1- Fisica Basica. Ed CP. Universidad de los Andes 1983. L. Martinez
2- My first Encounter with Astronomy. Kendall Hunt 2009. L. Martinez

Symposia.

1- L. Lopez . L. Martinez. Growth and Characterization on Monocrystal AgInSe2. ASOVAC , Marcay Venezuela, 1978.
2- Th. Leventouri, E. Liarokapis; L.T Willie; J.S. Fulkner, F.D. Medina, L. Martinez, V. Perdicates, B.D. Landreth. Y.S. Hasciecek, and L. Testardi.New Studies in the Bulk Orientation in the IBCO Superconductors. Bull of the APS, 35 N 3, 63 (1990)
3- E. Liarokapis; Th. Leventouri, L. Martinez and L.T. Willie. A Spectroscopy Study of the Ortorrombic to TetragonalPhase Transition in YBa2Cu3(1-x)Fe3xOx Superconductors. Bull of the APS, 35 N 3, 208 (1990)
4- J M Briceno, A. Lopez-Rivera, L. Martinez, et al. Correlation Study of High Resolution Electron Microscopy and Raman Spectrain Zn In2S4. Eight International Conference on Ternary and Multinary Compounds. Kishienev Rusia. (1990).
5 - J M Briceno, A. Lopez-Rivera, L. Martinez, F. Medina and W. Giriat. Nature of Photoluminescence Transitions in Zn1-xMnxS, Eight International Conference on Ternary and Multinary Compounds. Kishienev Rusia. (1990).
6-F. Medina, H. Wang, H.L. Yuang, C. Parbaniy, L. Martinez, S. A. Lopez-Rivera. The Yellow Emission S Band from Cr+ doped single ZnS Crystal. American Society March Meeting (19910
7- Y. Ye. F. Medina, H. Wang, X. Xu, L. Martinez and S.A. Lopez-Rivera. Study of Photoluminescence Band in Zn(1-x)MnxS Semiconductor Alloys. International conference on Luminescence University of Connecticut August (1993)

Biographical Sketch

Dr. Warner A. Miller
Professor and Chair of Physics
Department of Physics
Florida Atlantic University
Boca Raton, FL 33431-0991
Telephone: (561) 297-3380
Fax: (561) 297-2662
E-mail: wam@fau.edu

Professional Preparation

- University of Maryland at College Park; Double Major B.S. in Mathematics & Physics 1981
- The University of Texas at Austin; Advisor John Archibald Wheeler; Ph. D., Physics 1986
- Los Alamos National Lab., Theoretical Division, J. Robert Oppenheimer Fellowship 1990-93

Appointments

- Dept of Mathematics, Harvard University, Cambridge, MA, Visiting Scholar 2012-14
- Dept of Physics, Florida Atlantic University, Boca Raton, FL

Professor and Chair. 2003 –

- Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM
  Group Leader, TSM and J. R. Oppenheimer Fellow, Theoretical Astrophysics Group 1990–
- Officer USAF, Air Force Research Laboratory, Kirtland AFB, NM 2008
  Lt. Colonel USAF ret. and Laboratory Emeritus (Starfire Optical Range) 1981–2012

Publications of Immediate Interest

- W. Miller, J. McDonald, P. Alsing, X. Gu, S-T Yau, "Simplicial Ricci Flow," *Comm. Math. Phys.* **329** (2013) 579-608.
- P. Alsing, W. Miller, M. Corne, X. Gu, J. McDonald, S. Ray, C. Tison, S-T Yau, "Simplicial Ricci Flow: An Example of a Neck Pinch Singularity in 3D," *Geom., Imaging and Comp.* (2014) in press.
- W. A. Miller, P. Alsing, M. A. Corne $ S. Ray, "Equivalence of Simplicial Ricci Flow and Hamilton's Ricci Flow for 3D Neckpinch Geometries, submitted to *Geom., Imaging and Comp.* (2014).
- P. Alsing, J. McDonald & W. A. Miller, "The Simplicial Ricci Tensor, *Class. and Quantum Gravity* **28** (2011) 155007 (17pp).
- M. Corne, A. Kheyfets & W. A. Miller, Non-localizibility of Electric Coupling and Gravitational Binding of Charged Objects, Class. Quantum Gravity 24 (2007) 5999-6005.
- W. Miller, B. Schumacher & W. Zurek, "Kerr Black Hole in Thermodynamic Equilibrium with a Rotating Heat Bath, *Phys. Rev.* **D46** (1992) p. 1416.
- W. A. Miller, The Hilbert Action in Regge Calculus, Class. and Quantum Gravity 14 (1997) L199-L204.

Other Notable Publications

- B. Bromley, W. A. Miller and V. Pariev, "The Inner Edge of the Accretion Disk Around a Supermassive Black Hole, *Nature* **391** (1998) 54-56. (Letters to Nature, Cover Story: Closing in on a Black Hole).
- A. Gentle, D. Holz, W. Miller & J. A. Wheeler. "Apparent Horizons in Simplicial Brill-Wave Initial Data," *Class. Quantum Gravity* **16** (1999) 1979.
- J. McDonald & W. A. Miller, "A geometric construction of the Riemann Scalar Curvature in Regge Calculus, *Class. Quantum Gravity* **25** (2008) 195017.
- W. Zurek, A. Van der Merwe and W. Miller, eds. *Between Quantum and Cosmos* Princeton University Press (1988)
- W. A. Miller & J. A. Wheeler, "4- Geodesy, *Il Nuovo Cimento* **8C** (1985) 418-434.

Selected Honors

- 2009 Honorable Discharge, Lt. Col., USAF
- 2009 USAF Meritorious Service Medal, first Oak Leaf Cluster
- 2008 Publication of the Year, Directed Energy Directorate, AFRL.
- 2007 Giller Award for Technical Achievement, Directed Energy Directorate, AFRL.
- 1999 Los Alamos Achievement Award (Black Hole Astrophysics).
- 1998 Research Highlighted on the cover of Nature (January 1, 1998).
- 1993 USAF Meritorious Service Medal.
- 1992 Ira C. Eaker Fellowship, US Air Force Association given by Chief of Staff USAF.
- 1990 J. Robert Oppenheimer Fellowship, LANL.
- 1989 The 1989 Air Force Basic Research Award of the Secretary of the Air Force.
- 1986 Honor Society, $\Phi K \Phi$.
- 1981 Commissioned 2nd Lieutenant USAF.

Synergistic Activities

- 2012 Team Member, Engineering-A-Future for Diverse Middle School Students in Grades 6-7-8: Effects of Interdisciplinary-Problem-Based Curriculum Modules on Student Mastery of Core Engineering Practices. *NSF Letter of Intent Submitted to NSF by Nancy romance L02330845.*
- 2012 Student Mentor, Summer Faculty Fellowship Program, AFOSR (Dr. P. Alsing, AFRL) 10,11,12.
- 2009 Relativity & Relativistic Simulations, NSF Program Review.
- 2007 Committee of Visitors, SciDAC Program, DOE Office of Science.
- 2001 Selection Committee, CSGF Fellowship Program. 09, 07, 06, 04, 03, 02, 01

Collaborators and Other Affiliations

- **Recent Collaborators and Co-Editors**

P. Alsing (AFRL), R. Erdmann (AFRL), M. Fanto (AFRL), E. Galvez (Colgate), A. Gentle (USI), D. Gu (SUNY SB), J. McDonald (Harvard), A. Kheyfets (NCSU), G. Kreymerman (FAU), C. Tison (FAU), R. Williams (Cambridge), & A. P. Gentle (USI), X. Wang, S-T Yau (Harvard)

- **Graduate Advisor**

Professor John Archibald Wheeler (The University of Texas at Austin)

- **Thesis Advisees**

X. Wang, S. Ray, C. Tison, J. McDonald, R. Vaulin, A. Sabir, E. Vandernoot, N. Lafave, N. George, M. Galassi, A. Gentle, & G. Newton

- **Post-Graduate Associates Supervised**

P. Laguna, S. Habib, K. Chen, R. Laflamme, N. Lafave, B. Bromley & A. Gentle

Recent Grant Activity as PI

- Discrete Ricci Flow in Higher Dimensions, 2011-14, $759K Air Force Research Laboratory, FA 8750-11-2-0089.
- Solar System Astronomy, 2011-12, $12K NASA Florida Grant Consortium, FA 66016015-Y2.
- Single Photon Holographic Qudit Elements for Linear Optical Quantum Computing, 2009-10, $75K Air Force Research Laboratory, FA8750-10-2-0017.

Curriculum Vitae (2014)

Dr. Shen Li Qiu
Professor of Physics, Florida Atlantic University

Office: Science and Engineering (43), Rm. 102
Phone: (561) 297-3386
Email: qiu@fau.edu
Website: http://wise.fau.edu/~qiu/

Education

B.A. Physics 1969 Fudan University, Shanghai, China.
M.A. Physics 1981 City College of City University of New York.
Ph. D. Physics 1985 City College of City University of New York.
Dissertation Advisor: Distinguished Professor H. Z. Cummins.
Dissertation Title "Incommensurate phase transition in $NaNO_2$".
Postdoc 1985 – 1990, Department of Physics, Brookhaven National Lab.
Postdoctoral Mentor: Dr. Myron Strongin,

Employment

Department of Physics, Florida Atlantic University
2000 – Present Professor
1995 – 2000, Associate Professor
1990 – 1995, Assistant Professor
Department of Physics, Brookhaven National Lab
1989 – 1990, Associate Physicist
1987 – 1989, Assistant Physicist
1985 – 1987, Research Associate

Teaching Interests

1. Undergraduate courses have been taught at FAU since 1990:
   (a) Electromagnetism I and II for undergraduate students in Physics.
   (b) College Physics I and II (non-calculus based).
   (c) University Physics I and II (calculus based).
   (d) Modern Physics (lecture).
   (e) Experimental Modern Physics (lab).
   - Six brand new modern physics experiments have been setup since fall 2013.
   - Seven experiments have been computerized.
   - Ten new lab manuals have been written since fall 2013.
2. I received $40,000 from FAU Technology Fee Committee on May 5, 2014 for upgrading experimental modern physics lab and physical electronics lab.

3. Graduate courses have been taught at FAU since 2003:
   Electromagnetism I and II for PhD students in Physics.
4. PhD Dissertation/MS Thesis Supervision
   (a) Graduated Ph. D. students: Hong Ma, Florin Apostol
   (b) Graduated M.S. students: Wei Wang, Anthony T. Dorsey, Yu Liu, Biao Zhao

Books published and to be published

1. Two textbooks (editions 1, 2, 3) have been published:
   (a) D Haui Chen and Shen Li Qiu, "PHY2048L General Physics 1 Lab Manual", (Copley Custom Textbooks, an Imprint XanEdu Publishing, Inc.), 1st edition 2009, 2nd edition 2011, 3rd edition 2013.
   (b) D Haui Chen and Shen Li Qiu, "PHY2049L General Physics 2 Lab Manual", (Copley Custom Textbooks, an Imprint XanEdu Publishing, Inc.), 1st edition 2009, 2nd edition 2011, 3rd edition 2013.
2. Fourth edition of the two textbooks "PHY2048L General Physics 1 Lab Manual" and "PHY2049L General Physics 2 Lab Manual" will be published by Kendall Hunt Publishing Company in spring 2015.

Research

1. Research interests:
   First-principles total-energy calculations on phase equilibrium lines and saddle-point equilibrium lines which give a complete description of the static properties of two interacting crystal phases and their transition under pressure. The saddle-point equilibrium line plays an essential role in determination of accurate barrier height at transition pressure.
   Electronic structure of metals and alloys
   Magnetic structure of transition-metal compounds and thin-film multilayer systems
2. Refereed Publications and other presentations:
   (a) 84 refereed papers have been published (1983 -- present) in PRL, PRB, JPCM, EPJB, J. Appl. Phys.
   - The list of my publications is attached below.
   - The PDF files of my published papers can be found at:
   http://wise.fau.edu/~qiu/ (b) 45 Oral/Poster Presentations at Conferences.
   (c) 53 Reports in "National Synchrotron Light Source Annual Report".
3. Research Grants
   $447,190, from NSF, CNS-0521410, co-PI, 2005 – 2008.
   $227,050, from NSF, DMR-9500654, co-PI, 1995 - 2000 (extended).
   $231,900, from NSF, DMR-9120120, co-PI, 1992-1995.
   $14,000, from Research Corporation, PI, 1997 – 1998.
   $12,000, from NATO, PI, 1994 and 1996.
   $14,500 from BNL and NSLS, PI, 1991- 1993.
   $1,776, from FAU Foundation (UNB 212), PI, 1992-1993.
4. Journal Articles and grant proposals Reviewed:

(a) 96 articles (from 1995 to 2014) for PRL, PRB, JPCM and Journal of Applied Physics.
(b) 2 grant proposals for NSF and US Civilian Research and Development Foundation (CRDF).

Awards and Recognition

1. Teaching Incentive Program Award, FAU, 1993.
2. Researcher of the Year Award, FAU, 1994.

Service

1. Assistant, Associate and Acting Chair of Physics Department 2008 --- 2013
2. Committee work:
   (a) Honors Committee of College of Science (Category B) 2003 --- present
   (b) Equity Committee of College of Science (Category B) 2010
   (c) Qualifying exam committee of Physics Department (Category B) 2003 --- present
   (d) Ph.D. dissertation committees of Physics Department (Category B) 1993 --- present

   (e) Committee for Physics Undergraduate Award and the Nathan W. Dean Award in Physics (Category B) 2007 --- present

   Note: **Category B** - Service for which no remuneration or time is allotted.
3. Supervisor for Florida Science Olympiad Shock Value (B) 2/15/2014 (Category B).

Recent Refereed Publications (in reverse order)

(84) S.L. Qiu, "Hexagonal graphite to cubic diamond transition from equilibrium lines and barrier calculations", *Eur. Phys. J.* ***B*** **87**, 147 (2014).

(83) S.L. Qiu, and P.M. Marcus, "Saddle-point equilibrium lines between fcc and bcc phases in Al and Ca from first principles", *Eur. Phys. J.* ***B*** **86**, 425 (2013).

(82) S.L. Qiu, and P.M. Marcus, "Equilibrium lines and barriers to phase transitions: the cubic diamond to beta-tin transition in Si from first principles", *J. Phys.: Condens. Matter*. **24** 225501 (2012).

(81) S.L. Qiu, and P.M. Marcus, "Imma phase of Si: phase transitions and stability", *Eur. Phys. J.* ***B*** **81**, 411 (2011).

(80) S.L. Qiu, and P.M. Marcus, "Structure and stability under pressure of cubic and hexagonal diamond crystals of C, BN and Si from first principles", *J. Phys.: Condens. Matter* **23**, 215501 (2011).

(79) S.L. Qiu, and P.M. Marcus, "Instability in the Imma phase of Si", *Eur. Phys. Lett.* **92**, 27002 (2010).

(78) S.L. Qiu, and P.M. Marcus, "Phases of Ca from first principles", *J. Phys.: Condens. Matter* **21**, 435403 (2009).

(77) P.M. Marcus and S.L. Qiu, “Equilibrium lines and crystal phases under pressure”, *J. Phys.: Condens. Matter* **21**, 125404 (2009).

(76) P.M. Marcus and S.L. Qiu, “Elasticity in crystals under pressure”, *J. Phys.: Condens. Matter* **21**, 115401 (2009).

(75) S.L. Qiu, and P.M. Marcus, “New phases of zinc under pressure from first principles”, *Eur. Phys. J.* ***B*** **66**, 1 (2008).

(74) S.L. Qiu, F. Apostol and P.M. Marcus, “Bravais phases of Fe under pressure from first principles”, *J. Phys.: Condens. Matter* **20**, 345233 (2008).

(73) S.L. Qiu and P.M. Marcus, “Phases of vanadium under pressure investigated from first principles”, *J. Phys.: Condens. Matter* **20**, 275218 (2008).

(72) S.L. Qiu, F. Apostol and P.M. Marcus, “Low temperature properties of fcc Al from modified Debye theory”, J. Phys.: Condens. Matter **19**, 136213 (2007)

(71) S.L. Qiu, F. Apostol and P.M. Marcus, “Pressure dependence of the TO phonon frequency in hcp Zn”, J. Phys.: Condens. Matter **17**, 2121 (2005).

(70) P.M. Marcus and S.L. Qiu, “Reply to the Comment by G. Steinle-Neumann and R. E. Cohen on ‘On the importance of the free energy for elasticity under pressure’”, J. Phys.: Condens. Matter **16**, 8787 (2004).

(69) S.L. Qiu and P.M. Marcus, “Structural anomalies in hcp metals under pressure: Zn and Cd”, J. Phys.: Condens. Matter **16**, 6405 (2004).

(68) S.L. Qiu and P.M. Marcus, “First-principles derivation of structural anomalies in hcp Zn and hcp Fe under pressure”, J. Phys.: Condens. Matter **15,** L755-L761 (2003).

(67) S.L. Qiu and P.M. Marcus, “Elasticity of hcp nonmagnetic Fe under pressure”, Phys. Rev. B 68, 054103 (2003).

(66) P.M. Marcus, Franco Jona and S.L. Qiu, “Epitaxial Bain paths and metastable phases from first-principles total-energy calculations”, Phys. Rev. B 66, 064111 (2002).

(65) P.M. Marcus, Hong Ma, and S.L. Qiu, “On the importance of the free energy for elasticity under pressure”, J. Phys.: Condensed Matter 14, L525 (2002).

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(63) S. L. Qiu, P.M. Marcus and Hong Ma, " Epitaxial Bain path of tetragonal Fe", Phys. Rev. B64, 104431 (2001).

(62) S. L. Qiu, P.M. Marcus and Hong Ma, "The epitaxial Bain path of antiferromagnetic tetragonal Mn", Phys. Rev. B62 3292 (2000).

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(a) Professional Preparation

Hastings College	Physics	BA 1996
University of Tennessee	Physics	PhD 2002
University of Nebraska	Center for Materials Research and Analysis	2002—2005

(b) Appointments

8/2005—7/2011	Assistant Professor, Florida Atlantic University, Department of Physics, Boca Raton, FL
8/2011—7/2014	Assistant Scientist, Florida Atlantic University, Department of Physics, Boca Raton, FL
8/2014—Present	Associate Scientist, Florida Atlantic University, Department of Physics, Boca Raton, FL

(c) Publications

Most closely related to proposed project

1. K. D. Sorge, K. L. Klein, A. V. Melechko, C. L. Finkel, O. Malkina, Th. Leventouri, J. D. Fowlkes, P. D. Rack, and M. L. Simpson, "Magnetic Properties of Fe-Co Catalysts Used for Carbon Nanofiber Synthesis," *J. Appl. Phys*. **104**, 033909 (2008).
2. T. Leventouri, A. V. Melechko, K. D. Sorge, K. L. Klein, J. D. Fowlkes, P. D. Rack, I. M. Anderson, J. R. Thompson, T. E. McKnight, and M. L. Simpson, "Magnetic Alloys in Nanoscale Biomaterials," *Metallurgy. Mater. Trans. A* **37A**, 3423 (2006).
3. Y. Sui, R. Skomski, K. D. Sorge, and D. J. Sellmyer, "Nanotube magnetism," *Appl. Phys. Lett.* **84**, 1525 (2004).
4. Y. Sui, R. Skomski, K. D. Sorge, and D. J. Sellmyer, "Magnetic nanotubes produced by hydrogen reduction," *J. Appl. Phys.* **95**, 7151 (2004).
5. Korey D. Sorge, James R. Thompson, Thomas C. Schulthess, Frank A. Modine, Tony E. Haynes, Shin-ichi Honda, Alkiviathes Meldrum, John D. Budai, C. W. White, and Lynn A. Boatner,

"Oriented, single domain Fe nanoparticle layers in single crystal yttria-stabilized zirconia," *IEEE Trans. Magn.* **37**, 2197 (2001).

Other significant publications

6. K. D. Sorge, R. Skomski, M. Daniil, S. Michalski, L. Gao, J. Zhou, M. Yan, Y. Sui, R. D. Kirby, S. H. Liou, and D. J. Sellmyer, "Geometry and magnetism of $L1_0$ nanostructures," *Scripta Materialia* **53**, 457 (2005).
7. K. D. Sorge, A. Kashyap, R. Skomski, L. Yue, L. Gao, R. D. Kirby, S.-H. Liou, and D. J. Sellmyer, "Interactions and switching behavior of anisotropic magnetic dots," *J. Appl. Phys.* **95**, 7414 (2004).
8. R. Skomski, A. Kashyap, K. D. Sorge, and D. J. Sellmyer, "Multidomain and incoherent effects in magnetic nanodots," *J. Appl. Phys.* **95**, 7022 (2004).
9. C. W. White, S. P. Withrow, J. M. Williams, J. D. Budai, A. Meldrum, K. D. Sorge, J. R. Thompson, and L. A. Boatner, "FePt nanoparticles formed in Al_2O_3 by ion beam synthesis: Annealing environment effects," *J. Appl. Phys.* **95**, 8160 (2004).
10. T. C. Schulthess, M. Benakli, P. B. Visscher, K. D. Sorge, J. R. Thompson, F. A. Modine, T. E. Haynes, L. A. Boatner, G. M. Stocks, andW. H. Butler, "Role of magnetostatic interactions in assemblies of Fe nanoparticles," *J. Appl. Phys.* **89**, 7594 (2001).

(d) Synergistic Activities

- Member of the committee that is revamping the undergraduate and graduate physics curriculum at Florida Atlantic University.
- Undergraduate Physics advisor.
- Thesis advisor of two female graduate students.
- Reviewer for: J. Phys. Chem., J. Phys. D, Appl. Phys. Lett., and J. Appl. Phys.

(e) Collaborators and Other Affiliations

Collaborators: E. Belogay (FAU), C. Binek (Nebraska), P. Cosme (FAU), C. L. Finkel (FAU), J. D. Fowlkes (University of Tennesse and ORNL), D. B. Gopman (NYU), Y. Guan (Tennessee), S. M. Kajiura (FAU), K. L. Klein (Tennessee and ORNL) Th. Leventouri (FAU), Y. Liu (Alfred University), O. Malkina (FAU), A. V. Melechko (NC State), J. M. Perez (Central Florida), M. D. Potter (Nth Tech Corp), P. D. Rack (Tennessee), S. Sahoo (Nebraska), S. Santra (Central Florida), M. L. Simpson (Tennessee and ORNL), G. Sui (FAU), X. Wang (Alfred University)

Graduate and Postdoctoral Advisors: J. R. Thompson (Graduate Advisor at Tennessee and ORNL) and D. J. Sellmyer (Postdoctoral Sponsor at Nebraska)

Thesis Advisor of: C. L. Finkel (Graduate Student at FAU) and O. Malkina (Graduate Student at FAU)

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Education:

2001 Ph.D. in Physics, Cornell University, Ithaca, NY, USA
1996 Diplom in Physik, Universit¨at Karlsruhe, Karlsruhe

Appointments and professional Training:

2014-date Professor of Physics, Physics Department
Florida Atlantic University (FAU), Boca Raton, FL 33431, USA
2010-2014 Associate Professor of Physics, Physics Department
Florida Atlantic University (FAU), Boca Raton, FL 33431, USA
2005-2010 Assistant Professor of Physics, Physics Department
Florida Atlantic University (FAU), Boca Raton, FL 33431, USA

Research Interests:

- Numerical simulation of black holes and neutron stars, using finite difference or pseudo spectral methods
- Binary systems as sources of gravitational waves
- Construction of realistic initial data for black holes and neutron stars
- Post-Newtonian initial data for black holes

Recent Publications:

N. Moldenhauer, C. M. Markakis, N. K. Johnson-McDaniel, W. Tichy, B. Bruegmann, "Initial data for binary neutron stars with adjustable eccentricity", submitted to Physical Review D, Phys. Rev. **D90**, 084043, 2014, arXiv:1408.4136 [gr-qc]
W. Tichy, J. R. McDonald, W. A. Miller, "New efficient algorithm for the isometric embedding of 2-surface metrics in 3 dimensional Euclidean space", accepted for publication by Classical and Quantum Gravity

J. Aasi et al., W. Tichy [co-author], "The NINJA-2 project: Detecting and characterizing gravitational waveforms modelled using numerical binary black hole simulations", accepted for publication by Classical & Quantum Gravity Class. Quantum Grav. **31**, 115004 (2014), arXiv:1401.0939 [gr-qc]

S. Bernuzzi, T. Dietrich, W. Tichy, B. Bruegmann, "Mergers of binary neutron stars with realistic spin", Phys. Rev. **D89**, 104021, 2014, arXiv:1311.4443 [gr-qc]
I. Hinder et al., W. Tichy [co-author], "Error-analysis and comparison to analytical models of nu-merical waveforms produced by the NRAR Collaboration", Class. Quantum Grav. **31**, 025012 (2013), arXiv:1307.5307 [gr-qc]

P Ajith et al., W. Tichy [co-author], “Addendum to ”The NINJA-2 catalog of hybrid post-Newtonian/numerical-relativity waveforms for non-precessing black-hole binaries””, Class. Quantum Grav. **30**, 199401 (2013)

D. Hilditch, S. Bernuzzi, M. Thierfelder, Z. Cao, W. Tichy, B. Bruegmann, “Compact binary evolutions with the Z4c formulation”, Phys. Rev. **D88**, 084057, 2013, arXiv:1212.2901 [gr-qc]
W. Tichy, “Constructing quasi-equilibrium initial data for binary neutron stars with arbitrary spins”, Phys. Rev. **D86**, 064024, 2012, arXiv:1209.5336 [gr-qc]

G. Reifenberger and W. Tichy, “Alternatives to standard puncture initial data for binary black hole evolution”, Phys. Rev. **D86**, 064003, 2012, arXiv:1205.5502 [gr-qc]

P. Ajith et al., W. Tichy [co-author], “The NINJA-2 catalog of hybrid post Newtonian/numerical-relativity waveforms for non-precessing black-hole binaries”, Class. Quant. Grav. **29**, 124001 (2012), arXiv:1201.5319 [gr-qc]

P. Marronetti and W. Tichy, “Recent Advances in the Numerical Simulations of Binary Black Holes”, Proceedings of the Department of Energy SciDAC Workshop (2011), arXiv:1107.3703 [gr-qc]

W. Tichy, “Initial data for binary neutron stars with arbitrary spins ”, Phys. Rev. **D84**, 024041, 2011, arXiv:1107.1440 [gr-qc]

W. Tichy and E.´ E. Flanagan, “Covariant formulation of the post-1-Newtonian approximation to´General Relativity”, Phys. Rev. **D 84**, 044038, 2011, arXiv:1101.0588v1 [gr-qc]

W. Tichy and P. Marronetti, “A Simple method to set up low eccentricity initial data for moving puncture simulations”, Phys. Rev. **D 83**, 024012, 2011, arXiv:1010.2936v2 [gr-qc]

B. J. Kelly, W. Tichy, Y. Zlochower, M. Campanelli, B. F. Whiting, “Post-Newtonian Initial Data with Waves: Progress in Evolution”, Class. Quant. Grav. **27**, 114005, 2010, arXiv:0912.5311 [gr-qc]

N. K. Johnson-McDaniel, N. Yunes, W. Tichy, and B. J. Owen, “Conformally curved binary black hole initial data including tidal deformations and outgoing radiation”, Phys. Rev. **D 80**, 124039, 2009, arXiv:0907.0891 [gr-qc]

W. Tichy, “Long term black hole evolution with the BSSN system by pseudo-spectral methods”, Phys. Rev. **D 80**, 104034, 2009, arXiv:0911.0973v2 [gr-qc]

I. Vega, S. Detweiler, P. Diener, and W. Tichy, “Self-force with (3+1) codes: a primer for numerical relativists”, Phys. Rev. **D 80**, 084021, 2009, arXiv:0908.2138 [gr-qc]

W. Tichy, “A new numerical method to construct binary neutron star initial data”, Class. Quant. Grav. **26**, 175018 (2009), arXiv:0908.0620 [gr-qc]

B. Aylott et al., W. Tichy [co-author], “Testing gravitational-wave searches with numerical relativity waveforms: Results from the first Numerical INJection Analysis (NINJA) project”, Class. Quant. Grav. **26**, 165008 (2009), arXiv:0901.4399 [gr-qc]L. Cadonati et al., W. Tichy [co-

author], “Status of NINJA: the Numerical INJection Analysis project”, Class. Quant. Grav. **26**, 114008 (2009), arXiv:0905.4227 [gr-qc]W. Tichy and P. Marronetti, “The final mass and blac P. Marronetti, W. Tichy, B. Bru¨gmann, J. Gonzalez, and U. Sperhake, “High-spin binary black hole mergers”, Phys. Rev. **D 77**,064010 (2008), arXiv:0709.2160 [gr-qc]

Grants received:

- NSF Gravitation (PHY-1305387)
  Studies of General Relativistic Compact-Object Binaries
  Award: $126000, 09/01/2013-
  08/31/2016 PI: W. Tichy (FAU)
- NSF Gravitation (PHY-1204334)
  General Relativistic Simulations of binary compact Objects
  Award: $30000, 05/01/2012-
  04/30/2014 PI: W. Tichy (FAU)
- NSF Gravitation (PHY-0855315)
  Numerical Studies of Compact-Object Binaries
  Award: $200000, 08/01/2009-
  07/31/2013 PI: W. Tichy (FAU)
- NSF Gravitation (PHY-0652874)
  Numerical studies of binary black hole dynamics and waveforms
  Award $120000, 08/01/2007-07/31/2009
  PI: W. Tichy (FAU), Co-PI: P. Marronetti (FAU)
- NSF Gravitation (PHY-0555644)
  Orbiting binary black holes
  Award: $60000, 08/01/2006-07/31/2007
  PI: W. Tichy (FAU), Co-PI: P. Marronetti (FAU)

Recent Invited Talks:

Recent Talks given at International Conferences:

04/2014 “Binary neutron stars with realistic spin” APS April Meeting, Savannah, GA

04/2012 “Binary neutron stars with spin” APS April Meeting, Atlanta, GA

05/2011 “Binary neutron star initial data with spin” APS April Meeting, Anaheim, CA

05/2011 “Initial data for binary neutron stars with arbitrary spin” Gulf Gravity Meeting 2011, Florida Atlantic University, Boca Raton, FL

05/2009 “A new numerical method for the construction of binary neutron star initial data” APS April Meeting, Denver, CO

04/2008 “Binary black holes with spin: predicting the spin of the final black hole” APS April Meeting, St. Louis, MO

Teaching Experience:

since 2005 Lectures at Florida Atlantic University (FAU):
Undergraduate Level: General Physics I (2009), Intermediate Mechanics (2006),

Undergraduate Research (2014)
Graduate Level: Mechanics (2009-2013), Quantum Mechanics I & II (2005-2014), General Relativity (2011)

1996-2000 Teaching assistent at Cornell University:
Honors Physics Sequence: Modern Physics, Quantum Mechanics
Engineering Physics Sequence: Mechanics, Optics, Waves and Particles
Non-Major Sequence: Fundamentals of Physics, General Physics

1995-1996 Tutor in Physik an der Universit¨at Karlsruhe:
Quantenmechanik, Klassische Mechanik

Other Science related Activities:

- Co-developed and refined the BAM code for the numerical simulation of the Einstein Equations
- Developed the SGRID code to simulate the Einstein Equations using pseudo-spectral methods
- Member of the Florida Atlantic University SpaceTime (FAUST) group
- Member of the American Physical Society (APS)
- Collaboration with Bernd Bru¨gmann at Friedrich-Schiller-Universit¨at Jena on binary black hole and neutron star evolutions, as well as BAM code development

Awards:

- 2014 FAU Researcher of the Year Award in the category of Associate Professor at FAU
- 2006 College of Science Researcher of the Year Award in the category of Assistant Professor at FAU
- 1993 Baden-Wu¨rttemberg Austauschstipendium

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OBJECTIVE: To use my physics foundation and computer engineering experience to help build scientific, especially astronomical and physics, enthusiasm in a university and the general public.

EDUCATION:

M.S. in Physics, Florida Atlantic University, Boca Raton, FL, *2005*

B.S. in Physics, University of Connecticut, Storrs, CT, *1992*

PUBLICATION: "Iron Line Emission as a Probe of Bardeen-Petterson Accretion Disks", co-authored with Fragile and Miller, Astrophysical Jour. 635 157-166 (2005).

- Available online at http://xxx.lanl.gov/pdf/astro-ph/0507309

EMPLOYMENT: Florida Atlantic University, Boca Raton, FL

Astronomy & Physics Lab Coordinator, *Oct 2005 – Present*

- Created and teaches "Solar System Astronomy", a planetary mechanics course at FAU.
- Maintains, repairs & improves FAU's Astronomical Observatory.
- Provides about ten hours a week of lecture of night & solar observation sessions for the Intro to Astronomy students.
- Awarded FAU's Presidential Leadership Award in 2007 for Observatory improvements and outreach work.
- Awarded a grant to upgrade University telescope and equatorial drive, plus acquire a Halpha filter for solar observations, *2010*.
- Designed & built a vibration dampening platform to FAU's telescope pier; seismometer measurements showed vibrations have been reduced 1.5 orders of magnitude across its measured spectrum.
- Writes FAU's Observatory web pages; its coverage on light pollution is now being used as reference by other schools: *http://www.physics.fau.edu/observatory/observatory.html*
- Provides extensive outreach work to the community via the Observatory, by hosting school field trips, bi-monthly public viewing sessions, plus astronomically special events (Jupiter, Saturn, or Mars oppositions, Vesta Festival, Transit of Venus, …) or by bringing scopes and lectures to sites outside FAU; and via our annual "Pumpkin Drop" events (script writing, acting, equipment building).
- Maintains, repairs, builds and/or buys equipment for Physics Demo room.
- Writes an internal Physics Demo Room web pages for professors' usage.
- Maintained, repaired, built and/or bought equipment for Physics Labs.
- Administered weekly lab setup.
- Guided students in their Modern Physics Labs.

- Expanded Physics Lab II to increase student FTEs; Phy. Lab work is now a separate job.

Instructor, Physical Science - PSC-2121, *Fall 2005.*
Instructor, Introduction to Astronomy - AST-2002, *Summer B 2005.*
Teacher's Assistant, Intro. to Astronomy - AST-2002, *Summer A 2003 to Summer A 2005.*

- Created, coded and maintained a repository of approximately 1,200 online Blackboard quiz questions for the Fall 2003 to Summer A 2005 courses, which is still used today.

Instructor, Physics Laboratory 1 - PHY-2048, *Fall 2002 to Summer 2003.*

Software Engineer, Mercator Software, Boca Raton, FL, *1995 to 2001*.

- Designed, programmed, tested, and supported the Mercator Mapping Engine on AS/400, VMS and Stratus systems
- Ported Windows C code to work on the other platforms

- Engineered a front end interface to the AS/400 engine
- AS/400 Engine featured in the AS/400 Magazine, March 1999 issue, pg 34
- Troubleshot and resolved bugs in other platforms' engines
- Built an automated build process for AS/400 engine using PVCS archived code
- Designed and built a memory tracking system which is used across platforms
- Trained new AS400 developers on product and the system
- Constructed an AS/400 Mercator tutorial and presentation to help mentor fellow employees
- Worked directly with clients to provide product enhancements
- Supported professional services consultants in software demonstrations and implementations
- Influenced management to purchasing a computer based training library for developers.

DEVELOPMENT:

Research Specialist, University of Connecticut - Department of Metallurgy, Storrs, CT, *1992*.

- Prepared an Auger Spectrometer for computer control
- Built a power supply for an interface unit

Researcher, University of Connecticut - Department of Physics, Storrs, CT, *1992*.

- Conducted undergraduate level Cavendish Experiments by modernizing the process
- Reduced the experiment's analysis time from standard 1 month to 30 minutes with only seven percent error by using a computer to collect the data and perform the analysis.

VOLUNTEER: **Co-Founder and Vice President**, International Dark Sky Association South Florida Chapter, *2012-present*.

- Often give a talk about "The Exponentially Growing Pollutant: Light" to various community groups.
- Worked with Palm Beach County's Dept. of Environmental Resources Management, Gumbo Limbo Nature Center, and Okeeheelee Nature Center to plan, coordinate and put on PBC's Dark Sky Festivals, including giving the L.P. talk at them.

Volunteer, Gumbo Limbo Nature Center, Boca Raton, FL, *1998 – 2010*.

- Gave monthly lectures about Solar Observational Science at Observatory *(2007-2010)*
- Taught about the local fish and animals and their environment of South Florida
- Paid speaker at Gumbo Limbo's Eco-Watch Guest Lecture Series – "The Night Sky"

LANGUAGES: C, C++, Batch Scripts, AS/400 ILE CL, VOS ".cm" code, BASIC, PL-1
OP. SYSTEMS: OS/400, VMS, VOS, UNIX, Windows NT, DOS, SCO UNIX
HARDWARE: AS/400, Intel based PCs, DEC Alpha, Micro VAX, Stratus Continuum, Sun, HP and RS/6000

Luc T. Wille

Education:
B. S. Physics (1980), State University of Ghent (Belgium)
Ph. D. Physics (1983), State University of Ghent (Belgium)
M. S. Computer Science (1985), State University of Ghent (Belgium)

Employment:
1983-1985: Postdoctoral Researcher, State University Ghent (Belgium)
1985-1987: Postdoctoral Researcher, SERC Daresbury Laboratory (UK)
1987-1988: Postdoctoral Researcher, University of California, Berkeley
1988-present: Assistant Professor (1989-1991), Associate Professor (1991-1995), Professor (1995-present), Florida Atlantic University

Awards:
NATO Research Fellow (1985)
Laureate of the Royal Belgian Academy of Arts and Sciences (1988).
Teaching Incentive Program Awards, Florida Atlantic University (1993 and 1996).
Award for Excellence in Undergraduate Teaching, FAU (1991, 1995).
Award for Excellence in Undergraduate Advising, FAU (2000).
Distinguished Teacher of the Year Award, FAU (1996).
Visiting professor, Université Louis Pasteur, Strasbourg, France (1994-1996).
Visiting professor, Université de Nancy, France (1991-1994).

Funding:
Over $ 1,200,000 in funding from federal and local agencies. (PI or co-PI on grants from NSF, DOE, DARPA).

Publications:
Over 160 peer reviewed publications.
Editor of 10 volumes.

Theses completed under my supervision:
7 M. S. students.
8 Ph. D. students.