FLORIDA ATLANTIC UNIVERSITY

Dr. Th. Leventouri
Professor of Physics
Director, Center for Biological and Materials Physics
CBAMP
Department of Physics
Charles E. Schmidt College of Science

777 Glades Road
Boca Raton, FL 33431
Tel: 561.297.2695
Fax: 561.297.2662
lenentou@fau.edu
www.fau.edu

November 5, 2009

FROM: Dr. Th. Leventouri
TO: CESCOS GRADUATE CURRICULUM COMMITTEE

THRU: Dr. Warner A. Miller
Professor and Chair of the Physics Department

SUBJECT: Master of Science in Medical Physics (MSMP)

The Faculty and Chair of the Physics Department have unanimously decided to offer a Master of Science degree in Medical Physics (MSMP). The proposed program will utilize all the available resources in the existing Medical Physics Graduate Certificate Program (MPGCP).

The MSMP is a professionally oriented Master's of Science program that develops advanced scientific knowledge and professional skills. It 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. It is a 37 credit hours program (plus one 3 credit hours prerequisite) focused on preparation of students who are interested to develop a career in a health related field and/or continue for an advanced degree in Medical Physics.

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. According to the statistics of the American Institute of Physics, Medical Physicists are well compensated.

Career paths for Medical Physicists include: (1) Radiation Therapy Physicist (2) Diagnostic Medical Physicist (3) Nuclear Medical Physicist (4) Health Physicist. They also work in Research and Academia or at Companies that produce treatment equipment, treatment planning systems, and support materials. National statistics from the American Association of Physicists in Medicine show that approximately 76% work as Radiation Therapy Physicists.

This interdisciplinary program will broaden the scope of the Faculty and allow them to understand the role that physics can play in the modern world. In addition MSMP will offer our graduates more choices in career development.

At FAU there are opportunities for developing this program by using resources across three Colleges involving Faculty and courses from the: Charles E. Schmidt College of Science, Charles E. Schmidt College of Biomedical Science, and College of Engineering and Computer Science.

The support shown by Medical Physicists and Doctors in the area hospitals is a major asset in developing this Master's program. They serve as members of the Advisory Board, they successfully offer clinical training and classroom instruction through courtesy appointments to the current students of the Medical Physics Graduate Certificate Program (MPGCP). Such support, combined with the overall growth of South Florida, provides unique opportunities for professional development of our graduates.

Four out of the five core courses of the proposed MSMP have been offered to the students registered for the Medical Physics Graduate Certificate Program since the spring 09, while one is a prerequisite. The course PHY 6938 Nuclear Physics is listed in the university catalogue as a physics department elective. There are two new courses in the catalog description of MSMP: RAT 6629 *Advanced Photon Beam Radiation Therapy,* and RAT 6947 *Radiation Therapy: Clinical Practicum and Shadowing.* Research Affiliate Professors who have courtesy appointments with the Department of Physics will teach these courses.

Partners

- The Lynn Cancer Institute at the Boca Raton Community Hospital
- The Wellington Regional Medical Center
- Cancer Institute at the Research Park

Advisory Board

- Zoubir Ouhib, MS, DABR, Chief Medical Physicist Boca Raton Community Hospital. zouhib@brch.com
- Charles Shang, MS, BMED, DABR, Director, Medical Physicist Boca Raton Community Hospital. cshang@brch.com
- Tim R. Williams, MD Radiation Oncology, Medical Director The Lynn Cancer Institute at the Boca Raton Community Hospital. TWilliams@brch.com
- Michael E. Kasper MD, Radiation Oncology, The Lynn Cancer Institute at the Boca Raton Community Hospital. MKasper@brch.com
- Silvia Pella, PhD, DABR, Radiation Oncology Physicist, The Wellington Regional Medical Center. misipela@bellsouth.net, FAU alumna.
- Bruce S. Horowitz, DO Radiation Oncology, Director The Cancer Institute at the FAU Research Park. horowitzdr@aol.com
- Advisor from Nucletron (www.us.nucletron.com) to be named.
- Advisor from SENORX (www.senorx.com) to be named.
- Manny R. Subramanian Ph.D., Director of Research and Development, Best Medical International manny@teambest.com (www.teambest.com).

_____

CESCOS Graduate Curriculum Committee Chair

_____

Dean of CESCOS College of Science

_____

UPC Committee Chair

_____

Dean of Graduate College

FLORIDA ATLANTIC UNIVERSITY

Dr. Th. Leventouri
Professor of Physics
Director, Center for Biological and Materials Physics
CBAMP
Department of Physics
Charles E. Schmidt College of Science

777 Glades Road
Boca Raton, FL 33431
Tel: 561.297.2695
Fax: 561.297.2662
leventou@fau.edu
www.fau.edu

CATALOG DESCRIPTION

Master of Science in Medical Physics (MSMP)

Description

The Department of Physics offers the Master of Science in Medical Physics (MSMP) degree. The MSMP is a Professional M.S. innovative program that develops advanced scientific knowledge and professional skills. It is interdisciplinary and provides hands-on learning through on the 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, treatment of human disease, planning and development of treatment equipment. A Qualified Medical Physicist is competent to practice independently one or more of the subfields (tracks) of medical physics.

The MSMP is a 37 credit hours program (plus the 3 credits prerequisite course). It provides professional training in partnership with area hospitals focusing on the Radiation Therapy track which absorbs ~75% of Medical Physicists.

Admission Requirements

A BS in Physics. Candidates with a BS in Biology, Chemistry, Computer Science, or Engineering with a minor in Physics are considered.

- At least a 3.0 (of a 4.0 maximum) grade point average (GPA) in Science and Mathematics, courses.
- A combined score of 1000 or higher on the verbal and quantitative portions of the Graduate Record Examination (GRE). GRE scores more than five years old will not be accepted.

Prerequisite Course for the MSMP

PCB 3703. Human Morphology and Function 1 (3 credit hours). Normal structure and physiology of the human skeletal, muscle and nervous systems.

CURRICULUM

- 5 core courses
- 1 track-specific course
- 1 track-specific practicum course
- 1 frontier course
- 1 elective course
- 1 graduate research
- Master's Thesis
- (Optional: One summer practical clinical/research experience)

Total of 37 credit hours (plus the prerequisite). Typical duration is two years.

MSMP Courses

Core Courses

- RAT 6686. Radiation Physics (3 credit hours).
  Course covers the basics of ionizing and non-ionizing radiation, atomic and nuclear structure, basic nuclear and atomic physics, radioactive decay, interaction of radiation with matter, radiation detection, and dosimetry.

- BSC 6834. Introduction to Radiation Biology (3 credit hours)
  Prerequisite: permission of Instructor.
  An overview of the effects of ionizing radiations on human and other biological systems. The course involves consideration of cell survival after exposure to ionizing radiations, repair of radiation damage, radiosensitizers and radioprotectors, doses and risks in diagnostic radiology, cardiology, nuclear medicine, and basic safety rules. A student seminar is required at the end of the course.

- RAT 6628. Radiation Therapy Physics (3 credit hours)
  Prerequisite: RAT 6686
  Introductory course with a clinical orientation that reviews the rationale, basic science, methods, and applications of radiation therapy to the treatment of human diseases. Low- and high-energy photon therapy, electron and proton therapy, and low- and high-dose rate brachytherapy.

- PHY 6938/PHZ 6245. Medical Imaging Physics (3 credit hours)
  Course describes the basics of noninvasive imaging techniques, including Magnetic Resonance Imaging (MRI), functional MRI, Diffusion Tensor Imaging (DTI), electro- and magneto-encephalography (EEG, MEG). Course also covers analysis and visualization of high-dimensional datasets.

- PHZ 6245. Nuclear Physics (3 credit hours)
  Prerequisite: PHY 4604 (Quantum 1) or permission of Instructor. Radioactive decay processes, techniques of particle detection and energy measurement, nuclear reactions and scattering experiments, introduction to theories of

nuclear structure, fission and fusion processes, charged particle accelerators, and nuclear reactions, and elementary particle theory and experiments.

- *1 track-specific course: Radiation Therapy Track Core Course*
  RAT 6629. Advanced Photon Beam Radiation Therapy (3 credit hours)
  Prerequisite: RAT 6628.
  This course will cover the physics and clinical application of advanced external beam photon therapies with special emphasis on IMRT (Intensity Modulated Radiation Therapy).

- *1 track-specific practicum course: Radiation Therapy Track Practicum core course*
  RAT 6947. Radiation Therapy: Clinical Practicum and Shadowing (3 credit hours)
  Application of medical physics to cancer therapy in a hospital setting under close supervision. Dosimetry, calibrations, commissioning, radiation survey, and treatment planning. Clinically oriented laboratory-type projects are assigned.

- *1 frontier course* (3 credit hours)
  BME 6762. Bioinformatics: Bioengineering Perspectives 3 credits
  Prerequisite: Engineering/Science B.S. Introduction to bio- and genetic-engineering. Concepts and definitions of molecular biological terms. Bioinformatics—definition and applications. Information resources and databases: Proteins and genomes. Biological sequence analysis and applications. Sequence search/analyses tools and protocols. Bioinformatics versus modern information networks and the World Wide Web. (Neelakantas neelakan@fau.edu)

- *1 elective course* (3 credit hours)
  Students may choose from the following courses offered by an FAU department or center. All program electives are regular catalog courses. Students select with advisor's approval.

  STA 5195. Biostatistics 1
  Prerequisite: STA 4234 or STA 4102.
  An introduction to statistical tools used routinely for inference and data analysis in the health sciences. Topics include biostatistical design of medical studies, measure of disease occurrence and association, methods for rates and proportions, ROC analysis for screening and diagnosis, discrimination and classification, principal component analysis and factor analysis, log-linear models and survival analysis.

BSC 6936 Cell Structure and Function
This course provides a clear in-depth look into the discoveries made in the recent past and present especially focusing on the key concepts in the exciting areas of Eukaryotic Cell Structure and Function and Molecular Biology while studying a variety of biological processes at the cellular and molecular levels.

MAP 6211. Introduction to Dynamical Systems and Chaos. 3 credits.
2 Scalar autonomous equations, elementary bifurcations, scalar maps, one-dimensional chaos, scalar nonautonomous equations, bifurcations of periodic equations, equations on tori and circle maps, planar autonomous systems.

PCB 6207. Advanced Cell Physiology. 3 credits.
Prerequisite: Permission of Instructor. Course describes in-depth membrane physiology, intracellular signaling pathways, and cellular function, with an emphasis on neurons and human muscle cells (skeletal, smooth, and cardiac muscle cells).

- *PHY 6918. Graduate Research 3 credit hours*
  Prerequisite: Permission of Instructor. Supervised research for M.S.

- *RAT 6975 Master's Thesis Research 7 credit hours*
  Prerequisite: Permission of Instructor.
  Supervised by the Thesis Advisor.

Florida Atlantic University Board of Trustees

Request to Offer a New Degree Program

Florida Atlantic University University Submitting Proposal	Fall 2010 Proposed Implementation Date
Charles E. Schmidt College of Science Name of College or School	Department of Physics Name of Department
Medical Physics Academic Specialty or Field	Master of Science in Medical Physics (400801) Complete Name of Degree (Include Proposed CIP Code)

The submission of this proposal constitutes a commitment by the university that, if the proposal is approved, the necessary financial resources and the criteria for establishing new programs have been met prior to the initiation of the program.

Date Approved by the University Board of Trustees		President	Date
Signature of Chair, Board of Trustees	Date	Vice President for Academic Affairs	Date

Provide headcount (HC) and full-time equivalent (FTE) student estimates of majors for Years 1 through 5. HC and FTE estimates should be identical to those in Table 1. Indicate the program costs for the first and the fifth years of implementation as shown in the appropriate columns in Table 2. Calculate an Educational and General (E&G) cost per FTE for Years 1 and 5 (Total E&G divided by FTE).

Implementation Timeframe	Projected Student Enrollment (From Table 1)		Projected Program Costs (From Table 2)		
	HC	FTE	Total E&G Funding	Contract & Grants Funding	E&G Cost per FTE
Year 1	5	(5x0.5) 2.5	0.00	0.00	0.00
Year 2	8	4.0			
Year 3	10	5.0			
Year 4	12	6.0			
Year 5	15	7.5	0.00	0.00	0.00

Note: This outline and the questions pertaining to each section must be reproduced within the body of the proposal to ensure that all sections have been satisfactorily addressed.

INTRODUCTION

I. Program Description and Relationship to System-Level Goals

A. Briefly describe within a few paragraphs the degree program under consideration, including (a) level; (b) emphases, including concentrations, tracks, or specializations; (c) total number of credit hours; and (d) overall purpose, including examples of employment or education opportunities that may be available to program graduates.

The proposed *Professional Master of Science in Medical Physics (MSMP)* degree is a professionally oriented program that develops advanced scientific knowledge and professional skills. It 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. It is a 37 credit hour program (plus 3 credit hours prerequisite course) focused on preparation of students who are interested to develop a career in health related industry.

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. According to the statistics of the American Institute of Physics, Medical Physicists are in demand and well-compensated professionals, www.aip.org.

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. National statistics from the American Association of Physicists in Medicine (AAPM), www.aapm.org, show that approximately 76% of Medical Physicists work as *Radiation Therapy Physicists*. The proposed MSMP program provides specialization in Radiation Therapy. As the program grows, specialization in Diagnostic Imaging will be added.

At FAU there are opportunities for developing this program by using existing resources across three Colleges involving Faculty and courses from the: Charles E. Schmidt College of Science, Charles E. Schmidt College of Biomedical Science, and College of Engineering and Computer Science. To the advantage of the proposed MSMP, the Medical Physics Graduate Certificate Program (MPGCP) has started spring 09; four out of the five core courses in the proposed program are already offered to the students registered for the Certificate, while one is a prerequisite for the MPGCP.

A major asset in developing this MSMP program is the support shown by Medical Physicists and Doctors in the area hospitals. They serve as members of the MSMP Advisory Board. They already offer clinical training and classroom instruction to the current students of the MPGCP through courtesy appointments. This kind of support, combined with the overall growth of South Florida, provides unique opportunities for

professional placement of our graduates. Also, three companies have expressed support in the proposed program while their representatives serve on the MSMP Advisory Board.

B. Describe how the proposed program is consistent with the current State University System (SUS) Strategic Planning Goals. Identify which goals the program will directly support and which goals the program will indirectly support. (See the SUS Strategic Plan at http://www.flbog.org/StrategicResources/)

The proposed professional MSMP program fits with the goals and mission statements of both the SUS (http://www.flbog.org/StrategicResources/) and Florida Atlantic University (http://www.fau.edu/strategicplan/mission http://www.fau.edu/strategicplan/goals.php).

The proposed MSMP has established partnerships with local hospitals for the clinical practicum of the students. This is consistent with the Florida Atlantic University's Strategic Plan Goal 4 to build partnerships in key areas of the community, and the Mission Statement of the Charles E. Schmidt College of Science.

The highly technological interdisciplinary education in the proposed MSMP is in alignment with the Strategic Plan's Goal 2 on Meeting Statewide Professional and Workforce Needs. It also meets Nation's needs for professional degrees as stated by the NSF program solicitation 09-607.

The proposed MSMP is one of the professional Masters listed under *PSM Professional Science Master's Initiative State of Florida* www.FLPSM.org. It is also one of the 28 planned PSM programs at Florida Institutions that are included in: *A Statewide Initiative in Florida for Professional Masters Programs –A Proposal for Implementation. From the Florida Council of Graduate Deans Request of the Board of Governors.*

INSTITUTIONAL AND STATE LEVEL ACCOUNTABILITY

II. Need and Demand

A. Need: Describe national, state, and/or local data that support the need for more people to be prepared in this program at this level. Reference national, state, and/or local plans or reports that support the need for this program and requests for the proposed program which have emanated from a perceived need by agencies or industries in your service area. Cite any specific need for research and service that the program would fulfill.

According to the American Association of Physicists in Medicine (AAPM) and the Duke University (www.duke.edu) there are about 4000 Medical Physicists in the U.S. The current need is for approximately 250-300 new Medical Physicists per year. In addition, about 50% of current Medical Physicists are over the age of 50, meaning that there is likely to be an increasing shortage in the coming years due to retirement. Thus, there is a healthy job market for medical physics graduates, especially within the population growth of South Florida.

According to the American Institute of Physics: *Physics master's recipients accept positions in a variety of employment sectors. The master's employed at colleges and universities, which includes 2-year colleges and University Affiliated Research Institutes, are often laboratory coordinators, programmers, and instructors.* http://www.aip.org/statistics/trends/highlite/emp4/emphigh.htm. The proposed MSMP will provide the health related industry with highly qualified professionals.

B. Demand: Describe data that support the assumption that students will enroll in the proposed program. Include descriptions of surveys or other communications with prospective students.

The proposed MSMP is a highly demanding interdisciplinary program. Even so, there is a list of 9 prospective students. Likely pools of students include:

- The graduate and undergraduate students of the Physics Department. Four of them are enrolled in the Medical Physics Graduate Certificate Program (MPGCP).
- Graduate students of the Department of Chemistry and Biochemistry. Two of them are enrolled in Medical Physics courses as one of their electives, without officially being admitted in the program yet.
- Students in the College of Engineering have expressed interest in MSMP.
- Professionals working in hospitals as dosimetrists with a BS in Physics or Engineering and want to improve their professional status have expressed interest. One of them is currently enrolled in MPGCP.

The following Table contains the number of students enrolled in the Physics, Chemistry, Electrical Engineering and Computers Science Departments the last five years. The data were prepared by the office of Institutional Effectiveness and Analysis at FAU.

Department	2004-5	2005-6	2006-7	2007-8	2008-9
Physics Undergraduate	52	40	41	49	58
Physics Graduate	29	35	25	26	31
Chemistry Graduate	77	72	55	48	35
Electrical Engineering Graduate	63	61	62	60	38
Computer Engineering Graduate	83	72	64	63	66

Undergraduates are eligible to apply after graduation. Assuming that most of these students have not graduated, the size of this pool is substantial for the proposed program.

C. If similar programs (either private or public) exist in the state, identify the institution(s) and geographic location(s). Summarize the outcome(s) of any communication with such programs with regard to the potential impact on their enrollment and opportunities for possible collaboration (instruction and research). Provide data that support the need for

an additional program.

There is only one similar program in the state of Florida. It is at the University of Florida, but it is not listed as a Professional MS. It offers Master and Doctoral degrees in Medical Physics and is accredited by the Commission on Accreditation of Medical Physics Educational Programs (CAMPEP). According to the Interim Chairman and Director Dr. David E. Hintenlang, DABR, FACMP, they graduate an average of 9 students per year about evenly divided between MS and PhD degrees.

The demographics of South Florida combined with the demand as described in part A, are in favor of developing a professional MS as the proposed MSMP.

D. Use Table 1 (A for undergraduate and B for graduate) to categorize projected student headcount (HC) and Full Time Equivalents (FTE) according to primary sources. Generally undergraduate FTE will be calculated as 40 credit hours per year and graduate FTE will be calculated as 32 credit hours per year. Describe the rationale underlying enrollment projections. If, initially, students within the institution are expected to change majors to enroll in the proposed program, describe the shifts from disciplines that will likely occur.

The students targeted for this program most likely are students who would not change majors. In addition, we believe that a significant number of students will be full-time employees of hospitals and companies who would take the courses in late afternoons and evenings. We already have one such student in the MPGCP and one who is not yet qualified for acceptance. We anticipate that a typical student would take 24 credit hours in one academic year (9 credits in Fall and Spring, and 6 credits in Summer). The FTE numbers are calculated based on this assumption.

E. Indicate what steps will be taken to achieve a diverse student body in this program, and identify any minority groups that will be favorably or unfavorably impacted. <u>The university's Equal Opportunity Officer should read this section and then sign and date in the area below.</u>

We anticipate that the demographic characteristics of the proposed program will be similar to those of the undergraduate and graduate programs in Physics, and the graduate programs in Chemistry, Electrical Engineering and Computer Engineering.

FAU's Office of Institutional Effectiveness and Analysis has provided the data shown in the following Table for the academic year 2008-09.

Appropriate initiatives will be taken to ensure that the program is marketed to a diverse range of prospective students.

Department		Physics G	Physics UG	Chemistry G	Electrical Eng. G	Computer Eng. G
Total	#	31	58	35	38	66
Gender						
Female	#	9	15	21	11	18
	%	29.0	25.9	60.0	28.9	27.3
Male	#	22	43	14	27	48
	%	71.0	74.1	40.0	71.1	72.7
Ethnicity						
Asian Or Pacific Islander	#	1	1	1	2	12
	%	3.2	1.7	2.9	5.3	18.2
Black (Not of Hispanic Origin)	#	1	6	2	3	3
	%	3.2	10.3	5.7	7.9	4.5
Hispanic	#		8	3	13	7
	%		13.8	8.6	34.2	10.6
Non-Resident Alien	#	19	2	17	12	27
	%	61.3	3.4	48.6	31.6	40.9
White (Not of Hispanic Origin)	#	10	41	12	8	17
	%	32.3	70.7	34.3	21.1	25.8
Residency						
Non-Florida Resident	#	22	4	18	10	18
	%	71.0	6.9	51.4	26.3	27.3
Florida Resident	#	9	54	17	28	48
	%	29.0	93.1	48.6	73.7	72.7
Mean Age		31.2	25.2	29.8	33.0	31.4

_____ _____

Equal Opportunity Officer Date

III. Budget

A. Use Table 2 to display projected costs and associated funding sources for Year 1 and Year 5 of program operation. Use Table 3 to show how existing Education & General funds will be shifted to support the new program in Year 1. In narrative form, summarize the contents of both tables, identifying the source of both current and new resources to be devoted to the proposed program. (Data for Year 1 and Year 5 reflect snapshots in time rather than cumulative costs.)

Of the eight courses in the proposed MSMP to be offered by the Department of Physics, six are already in current programs of the department while one is listed in the catalog as elective. Only one course is new and it will be offered by the Affiliate Research Professors/Medical Physicists (courtesy appointments). No impact on Faculty

assignment.

The elective courses **(**E**)** courses were selected from those that are offered at FAU in the Charles E. Schmidt College of Science, or the Charles E. Schmidt College of Biomedical Science. Students are required to choose one of these electives. No impact on Faculty assignment.

The frontier course **(**F**)** *BME 6762 Bioinformatics* is regularly offered in the College of Engineering and Computer Science. No impact on Faculty assignment.

The course (R) *BSC 6834 Introduction in Radiation Biology* is regularly offered in the Charles E. Schmidt College of Biomedical Science. No impact on Faculty assignment.

The prerequisite course (PREREQ) *PCB 3703 Human Morphology and Function* is a regular course offered by the Biology Department. No impact on Faculty assignment.

B. If other programs will be impacted by a reallocation of resources for the proposed program, identify the program and provide a justification for reallocating resources. Specifically address the potential negative impacts that implementation of the proposed program will have on related undergraduate programs (i.e., shift in faculty effort, reallocation of instructional resources, reduced enrollment rates, greater use of adjunct faculty and teaching assistants). Explain what steps will be taken to mitigate any such impacts. Also, discuss the potential positive impacts that the proposed program might have on related undergraduate programs (i.e., increased undergraduate research opportunities, improved quality of instruction associated with cutting-edge research, improved labs and library resources).

There will be no reallocation of Faculty resources.

C. Describe other potential impacts on related programs or departments (e.g., increased need for general education or common prerequisite courses, or increased need for required or elective courses outside of the proposed major).

None.

D. Describe what steps have been taken to obtain information regarding resources (financial and in-kind) available outside the institution (businesses, industrial organizations, governmental entities, etc.). Describe the external resources that appear to be available to support the proposed program.

A partnership contract was signed last May between FAU and Boca Raton Community Hospital for the clinical training (practicum) of the students in the Medical Physics Program. Summer 2009 two students of the Medical Physics Graduate Certificate Program (MPGCP) were enrolled for the course Radiation Therapy Track Practicum and trained at Lynn Cancer Center of the BRCH.

Similar contracts are in the signing process with the Wellington Regional and the Cancer Institute at the FAU Research Park.

Three Companies support this Professional Master of Science in Medical Physics program: Nucletron (www.us.nucletron.com), SENORX (www.senorx.com) and Best Medical International (www.teambest.com).

Their representatives are members of the MSMP Advisory Board. In addition they offer training and internships to the students of the program.

IV. Projected Benefit of the Program to the University, Local Community, and State

Use information from Table 1, Table 2, and the supporting narrative for "Need and Demand" to prepare a concise statement that describes the projected benefit to the university, local community, and the state if the program is implemented. The projected benefits can be both quantitative and qualitative in nature, but there needs to be a clear distinction made between the two in the narrative.

FAU will gain visibility in the community, state and nation by developing the proposed professional MSMP program as a consequence of the following:

The former FAU President Brogan, as Chancellor of the State University System of Florida states that: *The State University System is strongly supportive of the Professional Science Master's Programs. PSM programs are an important element of our strategy in Florida to diversify our economy by producing graduates especially needed by Florida's industry sectors.* www.flpsm.org/.

Medical Doctors and Medical Physicists from local hospitals have expressed a need for the proposed MSMP program. They offer their support through partnership in clinical training of our students and advising in developing the MSMP.

Health related companies support the program by offering training and internships to students and advising in developing the professional MSMP.

V. Access and Articulation – Bachelor's Degrees Only

A. If the total number of credit hours to earn a degree exceeds 120, provide a justification for an exception to the policy of a 120 maximum and submit a request to the BOG for an exception along with notification of the program's approval. (See criteria in BOG Regulation 6C-8.014)

N/A

B. List program prerequisites and provide assurance that they are the same as the approved common prerequisites for other such degree programs within the SUS (see Common Prerequisite Manual http://www.facts.org). The courses in the Common Prerequisite Counseling Manual are intended to be those that are required of both native and transfer students prior to entrance to the major program, not simply lower-level courses that are required prior to graduation. The common prerequisites and substitute courses are

mandatory for all institution programs listed, and must be approved by the Articulation Coordinating Committee (ACC). This requirement includes those programs designated as "limited access."

If the proposed prerequisites are not listed in the Manual, provide a rationale for a request for exception to the policy of common prerequisites. NOTE: Typically, all lower-division courses required for admission into the major will be considered prerequisites. The curriculum can require lower-division courses that are not prerequisites for admission into the major, as long as those courses are built into the curriculum for the upper-level 60 credit hours. If there are already common prerequisites for other degree programs with the same proposed CIP, every effort must be made to utilize the previously approved prerequisites instead of recommending an additional "track" of prerequisites for that CIP. Additional tracks may not be approved by the ACC, thereby holding up the full approval of the degree program. Programs will not be entered into the State University System Inventory until any exceptions to the approved common prerequisites are approved by the ACC.

N/A.

C. If the university intends to seek formal Limited Access status for the proposed program, provide a rationale that includes an analysis of diversity issues with respect to such a designation. Explain how the university will ensure that community college transfer students are not disadvantaged by the Limited Access status. NOTE: The policy and criteria for Limited Access are identified in BOG Regulation 6C-8.013. Submit the Limited Access Program Request form along with this document.

N/A.

D. If the proposed program is an AS-to-BS capstone, ensure that it adheres to the guidelines approved by the Articulation Coordinating Committee for such programs, as set forth in Rule 6A-10.024 (see Statewide Articulation Manual http://www.facts.org). List the prerequisites, if any, including the specific AS degrees which may transfer into the program.

N/A.

INSTITUTIONAL READINESS

VI. Related Institutional Mission and Strength

A. Describe how the goals of the proposed program relate to the institutional mission statement as contained in the SUS Strategic Plan and the University Strategic Plan.

FAU's Strategic Plan includes seven goals. Goal 2 is to meet statewide professional and workforce needs. More specifically FAU is committed to expend the academic and fiscal resources to train professionals in "nursing, teaching and advanced technology". The proposed professional MS in Medical Physics is consistent with this goal.

B. Describe how the proposed program specifically relates to existing institutional strengths, such as programs of emphasis, other academic programs, and/or institutes and centers.

The proposed program builds on the intellectual resources of the Faculty in three established Colleges at Florida Atlantic University: the Charles E. Schmidt College of Science, the Charles E. Schmidt College of Biomedical Sciences and the College of Engineering and Computer Science. It strengthens the interdisciplinary cooperation among them in providing a professional innovative program to the students and the State of Florida.

C. Provide a narrative of the planning process leading up to submission of this proposal. Include a chronology (table) of activities, listing both university personnel directly involved and external individuals who participated in planning. Provide a timetable of events necessary for the implementation of the proposed program.

Biophysics is one of the research interests of several Faculty- members of the Center for Biological and Materials Physics (CBAMP) in the Physics Department. Such interests have lead to interactions with professionals in the community working in the medical field.

Discussions with medical doctors and medical physicists in the community, industrial representatives and graduating students were convincing that the job market in South Florida in particular needs well-prepared, highly technological individuals in the field of Medical Physics. It was recognized by all parties that physicists with their strong educational background in problem solving and the appropriate training could offer a lot in the public and industry sectors as professional medical physicists.

The Chair (Dr. Warner Miller) and Faculty (especially Drs. Korey Sorge and Andy Lau) in the Physics Department were very supportive in this effort.

Two years ago the Medical Physics Graduate Certificate Program (MPGCP) was approved and started spring 2009 with the first 5 students. This Certificate utilizes four out of six existing courses from two Colleges (Science and Biomedical), while it is offered at no additional cost to FAU.

Shortly after the MPGCP was approved in 2008, preparation of the professional Master of Science in Medical Physics. The AAPM report 79 (2002) *Academic Program Recommendations for Graduate Degrees in Medical Physics* as well as medical physics programs in accredited schools were considered in constructing the proposed MSMP. Meanwhile, Science magazine (27 March 2009 issue) presented the need for professional science master degrees (PSM) while NSF solicited Science Master's Program (SMP, NSF 09-607)) proposals Fall 2009.

The proposed MSMP is one of the three professional MS from the Charles E. Schmidt College of Science; regular PSM meetings started with the Dean of the Graduate College, Dr. Barry Rosson, the Associate Dean Dr. Larry Liebovitch of the Charles E.

Schmidt College of Science and all the PSM Professors/Program Directors.

At the beginning of the fall semester 2009 the proposed program MSMP was discussed with the members of the Curriculum Committee of the Physics Department. Next it was unanimously voted by the Faculty at the October 2009 meeting.

The Dean of the Charles E. Schmidt College of Biomedical Sciences Dr. Michael Friedland was contacted as well as the Professors from other departments who would participate in the proposed MSMP: Drs. Perambur Neelakanta, Kasirajan Ayyanathan, Stephen Locke, Lianfin Qian.

The proposed program was sent to the College Curriculum Committee. It was discussed and approved unanimously at the November 17, 2009 meeting.

Special effort is made in the proposed professional MSMP to integrate the University resources with the ones offered by the area hospitals and companies.

Planning Process

Date	Participants	Planning Activity
Fall 2008	Dr. Leventouri Dr. Miller Dr. Sorge	• The Medical Physics Graduate Certificate Program (MPGCP) was approved and appeared on the FAU catalog. • Discussions started on developing the MPGCP into a Master of Science in Medical Physics.
Spring 2009	Dr. Leventouri Dr. Pella (Medical Physicist, Wellington Regional) Z. Ouhib (Medical Physicist, BRCH) C. Shang (Medical Physicist, BRCH)	• The first five students were accepted in the MPGCP. Follow up efforts focused on setting partnerships between FAU and Hospitals in the area for the clinical training of the students. • Professional Master of Science Program initial development.
Summer 2009	Dr. Leventouri Dr. Williams (MD, BRCH, Director Lynn Cancer Institute) Z. Ouhib (Medical Physicist, BRCH) C. Shang (Medical Physicist, BRCH)	• Partnership between FAU and BRCH started. • The first students were accepted for clinical training. This will be partial fulfillment and credit towards the proposed professional MSMP. • MSMP was selected as one of the three professional Master in Science for the Statewide Initiative for PSM programs.
Fall 2009	Dr. Leventouri Curriculum Committee (Drs. Sorge, Lau, Beetle, Tichy) Faculty, Physics Department	• The proposed MSMP was presented to the Curriculum Committee of the Physics Department. Suggestions were considered.

	Medical Physicists (Dr. Pella, Ouhib, Dr. Shang) Medical Doctors (Drs. Williams, Horowitz) Representatives of healthcare industry.	• The Faculty of the Department of Physics voted unanimously in favor of the proposed MSMP (October). • The Faculty approved courtesy appointments for (Dr. Pella, Ouhib, Dr. Shang), and renewal for Dr. Horowitz (October). • The College Curriculum Committee reviewed and approved proposed program (November). • Advisory Board formed.

Events Leading to Implementation

Date	Implementation Activity
3/09	Seminar on Medical Physics: Zoubir Ouhib, Chief Medical Physicist Boca Raton Community Hospital. "Skin treatment with High Dose Rate (HDR)".
4/09	Meeting at Lynn Cancer Institute with the Director (Dr. Williams), 2 Medical Physicists (Ouhib, Chang) to discuss a partnership between FAU and BRCH for the clinical training of the Medical Physics students.
9/09	Recruitment: Presentation of the proposed MSMP to the students of the Charles E. Schmidt College of Science (Th. Leventouri).
12/09	Meeting with Advisory Board member Dr. Manny R. Subramanian, Director of Research and Development, Best Medical International to discuss students' internships offered by the Company.

VII. Program Quality Indicators - Reviews and Accreditation

Identify program reviews, accreditation visits, or internal reviews for any university degree programs related to the proposed program, especially any within the same academic unit. List all recommendations and summarize the institution's progress in implementing the recommendations.

The Southern Association of Colleges and Schools (SACS) Commission on Colleges has accredited all programs at Florida Atlantic University after the 2003 review.

On its most recent review (2009) the Charles E. Schmidt College of Science sites the following for the Physics Department: *Since the last review in 2001 we have made significant improvements to our undergraduate and graduate programs. In 2007 we introduced a new curriculum at the undergraduate level to make our students more competitive on the national level by providing them with a better mathematics and physics education.*

In 2008 we introduced a Medical Physics Graduate Certificate Program to prepare students who are interested in a career in a health related field and/or continue for an advanced degree in a medical program. The certificate requires 12 credit hours of graduate courses

including Radiation Therapy Physics, Radiation Biology, Medical Imaging Physics and the 3 credit prerequisite course Human Morphology and Function I (PCB 3703). This program is currently in its first year.

VIII. Curriculum

A. Describe the specific expected student learning outcomes associated with the proposed program. If a bachelor's degree program, include a web link to the Academic Learning Compact or include the document itself as an appendix.

The proposed MSMP is a professionally oriented Master's of Science program that develops advanced scientific knowledge and professional skills. Graduates of the MSMP program are expected to have a strong background in medical physics through the course work with emphasis in Radiation Therapy. In addition, their hands-on experience through clinical practicum in partnership with area hospitals focusing on the Radiation Therapy track will have them ready to join the workforce in the healthcare industry.

B. Describe the admission standards and graduation requirements for the program.

Applicants with a BS in Physics are admitted in the MSMP program. Candidates with a BS in Biology, Chemistry, Computer Science, or Engineering with a minor in Physics are considered.

At least a 3.0 (of a 4.0 maximum) grade point average (GPA) in Science and Mathematics courses is required.

A combined score of 1000 or higher on the verbal and quantitative portions of the Graduate Record Examination (GRE) is required. GRE scores more than five years old will not be accepted.

Students will be required to complete the 37 credits (plus the prerequisite 3 credits course) as described below with a 3.0 GPA or better to graduate.

C. Describe the curricular framework for the proposed program, including number of credit hours and composition of required core courses, restricted electives, unrestricted electives, thesis requirements, and dissertation requirements. Identify the total numbers of semester credit hours for the degree.

To complete the MSMP program students will need to take 5 core courses (15 credits), 1 track specific course (3 credits), 1 track-specific practicum course (3 credits), 1 frontier course (3 credits), 1 elective course (3 credits), 1 graduate research (3 credits), Master's Thesis (7 credits). **Total: 37 credits** (plus a 3 credits prerequisite course).

Four out of the five core courses of the proposed MSMP are offered in the Medical Physics Graduate Certificate Program (MPGCP) since spring 09. The course PHY 6938

Nuclear Physics is listed in the university catalogue as a physics department elective. The prerequisite is a regular course offered by the Biology Department. The two new courses, RAT 6629 *Advanced Photon Beam Radiation Therapy,* and RAT 6947 *Radiation Therapy Clinical Practicum and Shadowing,* will be offered by the Research Affiliate Professors who have courtesy appointments with the Physics Department. The frontier course BME 6762 *Bioinformatics* is regularly offered in the College of Engineering and Computer Science. All elective courses were selected from the ones that are offered in one of: the Charles E. Schmidt College of Science, Charles E. Schmidt College of Biomedical Science, or the College of Engineering and Computer Science.

The following Table lists the 8 courses to be offered by the Department of Physics for the proposed MSMP program. The first column contains the course identifier and number of credits. The second column lists the course name. The third column indicates whether the course is required (R) or elective (E). The fourth column indicates if the course is already offered (Y) for the MPGCP. The last column lists the course objectives.

Course	Course Name	MSMP	MPGCP	Course Objectives
RAT 6686 (3 credits)	*Radiation Physics*	R	Y	• The students will have a good understanding of radiation quantities and units, types and sources of ionizing radiation, interactions of charged particles and photons with matter, radioactivity. • They will be able to use the radiation physics knowledge that medical physicists need.
RAT 6628 (3 credits)	*Radiation Therapy Physics*	R	Y	• A clinically orientated learning that reviews the rationale, basic science, methods, and applications of radiation therapy to the treatment of human diseases. • Low and high-energy photon therapy, electron and proton therapy, and low and high-dose rate brachytherapy.
PHY 6938 (3 credits)	*Medical Imaging Physics*	R	Y	Learn about modern imaging techniques and technologies including MRI (magnetic resonance imaging) and functional MRI, full head EEG (electroencephalography), MEG (magnetoencephalography).
PHZ 6245 (3 credits)	*Nuclear Physics*	R	N	• Learn about theories of nuclear structure, fission and fusion processes, charged particle accelerators, nuclear reactions,

				elementary particle theory, radioactive decay. • Techniques of particle detection and energy measurement, nuclear reactions and scattering experiments.
RAT 6629 (3 credits)	*Advanced Photon Beam Radiation Therapy*	R	N	• Learn all the new and advanced radiation therapy, technologies, and methodologies available. • Prepared to perform QA, calibrations and acceptance of the treatment planning, MLCs, OBI systems and all the necessary tools to perform IMRT, IGRT, SRS.
RAT 6947 (3 credits)	*Radiation Therapy Track Practicum core course*	R	N	• At the end of this clinical practicum the students will have hands-on experience with the current radiation treatment technology and methods in dosimetry, radiation survey calibrations, commissioning, and treatment planning. • They will be prepared to analyze properly a new plan and approve or disapprove it. • They will be able to perform QA, calibrations and acceptance of the treatment planning systems.
PHY 6918 (3 credits)	*Graduate Research*	R	N	• Supervised research in the field of Medical Physics.
RAT 6975 (7 credits)	*Master's Thesis Research*	R	N	• Research supervised by the Thesis Advisor.

The following Table lists courses offered at FAU, outside the Department of Physics. It contains:

- The elective courses **(**E**)** suitable for the MSMP program. **Students are required to choose one of the E.** The elective courses were selected from those that are offered at FAU in the Charles E. Schmidt College of Science, or the Charles E. Schmidt College of Biomedical Science.
- The frontier course **(**R**),** *BME 6762 Bioinformatics*, is regularly offered in the College of Engineering and Computer Science.
- The prerequisite course (PREREQ) Human Morphology and Function 1 is a regular course offered by the Biology Department.
- The required course (R) *BSC 6834 Introduction to Radiation Biology* is a regular

course offered in the Charles E. Schmidt College of Biomedical Science.

The first column contains the course identifier and number of credits. The second column lists the course name. The third column indicates whether the course is required (R) or elective (E) for the proposed MSMP. The fourth column indicates if the course is already offered (Y) or not (N) for the MPGCP. The last column lists the course objectives.

Course	Course Name	MSMP	MPGCP	Course Objectives
STA 5195 (3 credits)	Biostatistics 1	E	N	Learn the statistical tools used routinely for inference and data analysis in the health sciences. Biostatistical design of medical studies, measure of disease occurrence and association.
BSC 6936 (3 credits)	Cell Structure and Function	E	N	Learn about a variety of biological processes at the cellular and molecular levels.
MAP 6211 (3 credits)	Introduction to Dynamical Systems and Chaos	E	N	Learn about 2 Scalar autonomous equations, elementary bifurcations, scalar maps, one-dimensional chaos, scalar nonautonomous equations
PCB 6207 (3 credits)	Advanced Cell Physiology	E	N	In-depth learning about membrane physiology, intracellular signaling pathways, and cellular function, with an emphasis on neurons and human muscle cells
BSC 6834 (3 credits)	Introduction to Radiation Biology	R	Y	Learn about the effects of ionizing radiations on human and other biological systems.
BME 6762 (3 credits)	Bioinformatics	R	N	Learn about information resources and databases: Proteins and genomes. Biological sequence analysis and applications. Sequence search/analyses tools and protocols
PCB 3703 (3 credits)	Human Morphology and Function 1	PREREQ	Y	Learn about normal structure and physiology of the human skeletal, muscle and nervous systems.

D. Provide a sequenced course of study for all majors, concentrations, or areas of emphasis within the proposed program.

Students must take PCB 3703 before they enroll in the other courses required by the program.
The sequence of the elective courses will be determined by the student, in consultation with an advisor in the program.

The following Table lists a proposed schedule of courses:

Spring year 1	c	Fall year 1	c	Summer C	c	Spring year 2	c	Fall year 2	c
RAT 6686	3	RAT 6628	3	RAT 6947	3	RAT 6629	3	PHZ 6245	3
PHY 6938	3	BSC 6834	3			BME 6762	3	RAT 6975	4
Elective	3	PHY 6918	3			RAT 6975	3		
	9		**9**		**3**		**9**		**7**

Total of 37 credit hours (plus the prerequisite PCB 3703).

E. Provide a one- or two-sentence description of each required or elective course.

Course #	Course Nane	R/E	Course Description
RAT 6686	Radiation Physics	R	Ionizing and non-ionizing radiation, atomic and nuclear structure, basic nuclear and atomic physics. Radioactive decay, interaction of radiation with matter, radiation detection.
PHY 6938	Medical Imaging Physics	R	Magnetic Resonance Imaging (MRI), functional MRI, Diffusion Tensor Imaging (DTI), electro- and magneto-encephalography (EEG, MEG).
BSC 6834	Introduction to Radiation Biology	R	Effects of ionizing radiations on human and other biological systems.
RAT 6628	Radiation Therapy Physics	R	A clinical orientation that reviews the rationale, basic science, methods, and applications of radiation therapy to the treatment of human diseases. Low- and high-energy photon therapy, electron and proton therapy, and low- and high-dose rate brachytherapy.
PHZ 6245	Nuclear Physics	R	Introduction to theories of nuclear structure, fission and fusion processes. Charged particle accelerators, and nuclear reactions. Elementary particle theory and experiments.
RAT 6629	Advanced Radiation Therapy Physics	R	Physics and clinical application of advanced external beam photon therapies with special emphasis on IMRT (Intensity Modulated Radiation Therapy).
RAT 6947	Radiation Therapy: Clinical Practicum & Shadowing	R	Application of medical physics to cancer therapy in a hospital setting under close supervision. Dosimetry, calibrations, commissioning, radiation survey, and treatment planning.
BME 6762	Bioinformatics	R	Introduction to bio- and genetic-engineering. Bioinformatics-definition and applications. Information resources and databases: Proteins and genomes. Biological sequence analysis and applications.
PHY 6918	Graduate Research	R	Supervised research in physics for master's degree.
RAT 6975	Master's Thesis Research	R	Research in Medical Physics supervised by the Thesis Advisor.
STA 5195	Biostatistics	E	An introduction to statistical tools for inference and data analysis in health sciences. Biostatistical design of medical studies, measure of disease occurrence and association, methods for rates and proportions, ROC analysis for screening and diagnosis.

BSC 6936	Cell Structure & Function	E	Key concepts in the exciting areas of Eukaryotic Cell Structure and Function and Molecular Biology. Studies of a variety of biological processes at the cellular and molecular levels.
MAP 6211	Intro to Dynamical Systems and Chaos	E	Scalar autonomous equations, elementary bifurcations, scalar maps, one-dimensional chaos, scalar non autonomous equations, bifurcations of periodic equations, equations on tori and circle maps, planar autonomous systems.
PCB 6207	Advanced Cell Physiology	E	In-depth membrane physiology, intracellular signaling pathways, and cellular function, with an emphasis on neurons and human muscle cells.

F. For degree programs in the science and technology disciplines, discuss how industry-driven competencies were identified and incorporated into the curriculum and identify if any industry advisory council exists to provide input for curriculum development and student assessment.

Please see Planning Process in VI. C.

The Advisory Board of the proposed MSMP consists of Medical Physicists and Medical Doctors working in area Hospitals, and representatives of health related Companies.

G. For all programs, list the specialized accreditation agencies and learned societies that would be concerned with the proposed program. Will the university seek accreditation for the program if it is available? If not, why? Provide a brief timeline for seeking accreditation, if appropriate.

After successful implementation of the proposed program for a few years a self-assessment report will be submitted to the Commission on Accreditation of Education in Medical Physics Programs (CAMPEP) seeking accreditation of the proposed program. **CAMPEP** is a nonprofit organization whose objectives are the review and accreditation of educational programs in Medical Physics. www.campep.org.

H. For doctoral programs, list the accreditation agencies and learned societies that would be concerned with corresponding bachelor's or master's programs associated with the proposed program. Are the programs accredited? If not, why?

N/A

I. Briefly describe the anticipated delivery system for the proposed program (e.g., traditional delivery on main campus; traditional delivery at branch campuses or centers; or nontraditional delivery such as distance or distributed learning, self-paced instruction, or external degree programs). If the proposed delivery system will require specialized services or greater than normal financial support, include projected costs in Table 2. Provide a narrative describing the feasibility of delivering the proposed program through collaboration with other universities, both public and private. Cite specific queries made of other institutions with respect to shared courses, distance/distributed learning technologies, and joint-use facilities for research or internships.

All courses in the proposed program will be offered on maim campus except for two: The prerequisite course PCB 3703 *Human Morphology and Function 1* is offered in Davie campus. The practicum course RAT 6947 *Radiation Therapy, Clinical Practicum & Shadowing* will be offered at the hospitals that FAU has partnerships with in providing the professional training to the students of the MSMP.

IX. Faculty Participation

A. Use Table 4 to identify existing and anticipated ranked (not visiting or adjunct) faculty who will participate in the proposed program through Year 5. Include (a) faculty code associated with the source of funding for the position; (b) name; (c) highest degree held; (d) academic discipline or specialization; (e) contract status (tenure, tenure-earning, or multi-year annual [MYA]); (f) contract length in months; and (g) percent of annual effort that will be directed toward the proposed program (instruction, advising, supervising internships and practice, and supervising thesis or dissertation hours).

For participating ranked Faculty see Table 4. Participating Faculty from departments other than Physics were not counted in FTE or % of annual effort toward the proposed program, because they offer the corresponding courses for their home departments.

Important note

In addition to the Faculty Participation as in Table 4, the Department of Physics has four Research Affiliate Professors (courtesy appointments) listed in the following Table. All four are members of the Advisory Board of the proposed Master of Science in Medical Physics (MSMP). Three are fully certified Medical Physicists working in local hospitals and one is Radiation Oncologist. They already teach at the Medical Physics Graduate Certificate Program (MPGCP) two courses. The same two courses are required for the proposed professional MSMP and will be offered by them.
Relevant information is provided in the following Table:

Research Affiliate Professor (courtesy appointment)	**Course in MPGCP Required in MSMP**
Silvia Pella Ph.D. DABR Wellington Regional Medical Center	RAT 6628 Radiation Therapy Physics
Zoubir Ouhib MS, DABR Chief Medical Physicist Boca Raton Community Hospital	RAT 6947 Radiation Therapy Track Practicum Course
Charles Shang, MS, BMED, DABR Director, Medical Physicist, BRCH	RAT 6947 Radiation Therapy Track Practicum Course
Bruce S. Horowitz, DO Radiation Oncology Director, The Cancer Institute at the FAU Research Park	RAT 6628 Radiation Therapy Physics

B. Use Table 2 to display the costs and associated funding resources for existing and anticipated ranked faculty (as identified in Table 2). Costs for visiting and adjunct faculty should be included in the category of Other Personnel Services (OPS). Provide a narrative summarizing projected costs and funding sources.

See Table 2.

C. Provide the number of master's theses and/or doctoral dissertations directed, and the number and type of professional publications for each existing faculty member (do not include information for visiting or adjunct faculty).

Faculty Name	Theses (Graduated)	Dissertations (Graduated)	Professional Publications **Total:** papers in journals + book chapters + papers in proceedings
Th. Leventouri	3	5	106
Armin Fuchs	0	4	61
Victor Jirsa	0	3	45
Andy Lau	0	0	42
Korey Sorge	0	0	32
Perambur Neelakanta	25	15	154
Jay Lyons	8	0	25
Armando Zea	0	0	12
Wen Shen	2	4	16
Lianfen Qian	3	0	24
Kasirajan Ayyanathan	3	0	19

D. Provide evidence that the academic unit(s) associated with this new degree have been productive in teaching, research, and service. Such evidence may include trends over time for average course load, FTE productivity, student HC in major or service courses, degrees granted, external funding attracted, as well as qualitative indicators of excellence.

The following Table provides information on the productivity of the Department of Physics for the Academic years 2007-2009. Similar data for Biology, Electrical Engineering and Biomedical Science can be provided upon request.

Year	Introductory (plus Service) Courses Enrollments	UG Physics Majors Enrollments	Graduate Physics Enrollments	Physics BS Degrees	Physics MS Degrees	Physics PhD Degrees
2009	2,820	20	28	3	1	2
2008	2,610	19	26	5	2	0
2007	2,359	19	28	6	1	2

Department of Physics external funding:

- $300,000 for the year 2007-08
- $609,500 for the year 2008-09

X. Non-Faculty Resources

A. Describe library resources currently available to implement and/or sustain the proposed program through Year 5. Provide the total number of volumes and serials available in this discipline and related fields. List major journals that are available to the university's students. Include a signed statement from the Library Director that this subsection and

subsection B have been reviewed and approved for all doctoral level proposals.

The FAU libraries on the Boca Raton, Jupiter, and Tower campuses together contain a great number of journals, books and other resources related to the proposed program. The FAU library subscribes to physics, medicine, biology, and computer science resources (e.g. 305 journals in Science, 253 in Physics, 141 journals in Medical Physics, Radiology, MRI, & Ultrasonography, 833 in Computer Science etc.)

B. Describe additional library resources that are needed to implement and/or sustain the program through Year 5. Include projected costs of additional library resources in Table 3.

None

_____ _____

Library Director Date

C. Describe classroom, teaching laboratory, research laboratory, office, and other types of space that are necessary and currently available to implement the proposed program through Year 5.

Current classrooms and teaching facilities at FAU campuses are sufficient for all courses offered in this program.

Hospitals/Partners provide the facilities for the clinical practicum.

D. Describe additional classroom, teaching laboratory, research laboratory, office, and other space needed to implement and/or maintain the proposed program through Year 5. Include any projected Instruction and Research (I&R) costs of additional space in Table 2. Do not include costs for new construction because that information should be provided in response to X (J) below.

None

E. Describe specialized equipment that is currently available to implement the proposed program through Year 5. Focus primarily on instructional and research requirements.

None

F. Describe additional specialized equipment that will be needed to implement and/or sustain the proposed program through Year 5. Include projected costs of additional equipment in Table 2.

None

G. Describe any additional special categories of resources needed to implement the program through Year 5 (access to proprietary research facilities, specialized services, extended travel, etc.). Include projected costs of special resources in Table 2.

None

H. Describe fellowships, scholarships, and graduate assistantships to be allocated to the proposed program through Year 5. Include the projected costs in Table 2.

The proposed MSMP is sustainable at the initial phase of the program implementation.

I. Describe currently available sites for internship and practicum experiences, if appropriate to the program. Describe plans to seek additional sites in Years 1 through 5.

Three Medical facilities in the area and in partnership with FAU will offer their facilities for the clinical practicum of the proposed professional MSMP:

- *The Lynn Cancer Institute* at the Boca Raton Community Hospital.
- *The Wellington Regional Medical Center.*
- *The Cancer Institute* at the FAU Research Park.

The company *Best Medical International* will offer internships to prospective students of MSMP.

J. If a new capital expenditure for instructional or research space is required, indicate where this item appears on the university's fixed capital outlay priority list. Table 2 includes only Instruction and Research (I&R) costs. If non-I&R costs, such as indirect costs affecting libraries and student services, are expected to increase as a result of the program, describe and estimate those expenses in narrative form below. It is expected that high enrollment programs in particular would necessitate increased costs in non-I&R activities.

None
.

TABLE 1-B
PROJECTED HEADCOUNT FROM POTENTIAL SOURCES
(Graduate Degree Program)

Source of Students (Non-duplicated headcount in any given year)*	Year 1		Year 2		Year 3		Year 4		Year 5	
	HC	FTE	HC	FTE	HC	FTE	HC	FTE	HC	FTE
Individuals drawn from agencies/industries in your service area (e.g., older returning students)	2	1.0	2	1.0	3	1.5	3	1.5	5	2.5
Students who transfer from other graduate programs within the university**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Individuals who have recently graduated from preceding degree programs at this university	1	0.5	4	2.0	4	2.0	4	2.0	5	2.5
Individuals who graduated from preceding degree programs at other Florida public universities	0	0.0	1	0.5	1	0.5	2	1.0	3	1.5
Individuals who graduated from preceding degree programs at non-public Florida institutions	0	0.0	0	0.0	0	1.0	1	0.5	0	0.0
Additional in-state residents***	0	0.0	1	0.5	1	0.5	1	0.5	1	0.5
Additional out-of-state residents***	0	0.0	0	0.0	0	0.0	1	0.5	1	0.5
Additional foreign residents***	2	0.0	0	0.0	1	0.5	0	0.0	0	0.0
Other (Explain)***	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Totals	**5**	**2.5**	**8**	**4**	**10**	**5.0**	**12**	**6.0**	**15**	**7.5**

* List projected yearly cumulative ENROLLMENTS instead of admissions

** If numbers appear in this category, they should go DOWN in later years.

*** Do not include individuals counted in any PRIOR category in a given COLUMN.

TABLE 2
PROJECTED COSTS AND FUNDING SOURCES

Instruction & Research Costs (non-cumulative)	**Year 1**						**Year 5**				
	Funding Source					**Subtotal E&G and C&G**	Funding Source				**Subtotal E&G and C&G**
	Reallocated Base* (E&G)	Enrollment Growth (E&G)	Other New Recurring (E&G)	New Non-Recurring (E&G)	Contracts & Grants (C&G)		Continuing Base** (E&G)	New Enrollment Growth (E&G)	Other*** (E&G)	Contracts & Grants (C&G)	
Faculty Salaries and Benefits	0	0	0	0	0	**$0**	0	0	0	0	**$0**
A & P Salaries and Benefits	0	0	0	0	0	**$0**	0	0	0	0	**$0**
USPS Salaries and Benefits	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Other Personnel Services	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Assistantships & Fellowships	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Library	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Expenses	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Operating Capital Outlay	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Special Categories	0	0	0	0	0	**$0**	0	0	0	0	**$0**
Total Costs	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

*Identify reallocation sources in Table 3.

**Includes recurring E&G funded costs ("reallocated base," "enrollment growth," and "other new recurring") from Years 1-4 that continue into Year 5.

***Identify if non-recurring.

Faculty and Staff Summary

Total Positions (person-years)	Year 1	Year 5
Faculty	0	0
A & P	0	0
USPS	0	0

Calculated Cost per Student FTE

	Year 1	Year 5
Total E&G Funding	$0	$0
Annual Student FTE	4	8
E&G Cost per FTE	$0	$0

TABLE 3
ANTICIPATED REALLOCATION OF EDUCATION & GENERAL FUNDS

Program and/or E&G account from which current funds will be reallocated during Year 1	Base before reallocation	Amount to be reallocated	Base after reallocation
Totals	**$0**	**$0**	**$0**

TABLE 4
ANTICIPATED FACULTY PARTICIPATION

Faculty Code	Faculty Name or "New Hire" Highest Degree Held Academic Discipline or Specialty	Rank	Contract Status	Initial Date for Participation in Program	Mos. Contract Year 1	FTE Year 1	% Effort for Prg. Year 1	PY Year 1	Mos. Contract Year 5	FTE Year 5	% Effort for Prg. Year 5	PY Year 5
A	Th. Leventouri, Ph.D. Physics	Professor	Tenure	2010	9	1	50.00	0.5	9	1	50	0.50
A	Armin Fuchs, Ph.D. Physics	Associate	Tenure	2010	9	1	12.50	0.125	9	1	12.50	0.125
A	V. K. Jirsa, Ph.D. Physics	Associate	Tenure	2011	9	.78	0	0	9	0.78	12.50	0.125
A	Andy Law, Ph.D. Physics	Associate	Tenure	2011	9	1	0	0	9	1	12.50	0.125
A	Korey Sorge, Ph.D. Physics	Assistant	Tenure-track	2011	9	1	0	0	9	1	12.50	0.125
A	Perambur Neelakanta, Ph.D. El. Engineering	Professor	Tenure	2010	9	0	0	0	9	0	0	0
A	Armando Zea, MS Health Physics	AMP	MYA	2010	12	0	0	0	12	0	0	0
A	Kasirajan Ayyanathan, Ph.D. Biology	Associate	Tenure-track	2010-	9	0	0	0	9	0	0	0
A	Jay Lyons, Ph.D. Biology	Associate	Tenure	2010	9	0	0	0	9	0	0	0
A	Wen Shen, Ph.D. Physiology, Biophysics	Associate	Tenure	2010	9	0	0	0	9	0	0	0
A	Lianfen Qian, Ph.D. Mathematics (Statistics)	Professor	Tenure	2010	9	0	0	0	9	0	0	0
	Total Person-Years (PY)							**1.25**				**5**

Faculty Code		Source of Funding	PY Workload by Budget Classification Year 1	Year 5

A	Existing faculty on a regular line	Current Education & General Revenue		0.00		0.00
B	New faculty to be hired on a vacant line	Current Education & General Revenue		0.00		0.00
C	New faculty to be hired on a new line	New Education & General Revenue		0.00		0.00
D	Existing faculty hired on contracts/grants	Contracts/Grants		0.00		0.00
E	New faculty to be hired on contracts/grants	Contracts/Grants		0.00		0.00
		Overall Totals for	**Year 1**	**0.00**	**Year 5**	**0.00**