Cover Sheet: Request 13848

Physics BS Specialization in Nanoscience

Info

Process	Specialization|New/Modify/Close|Ugrad
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Selman Hershfield selman@phys.ufl.edu
Created	4/12/2019 12:23:50 PM
Updated	11/11/2019 12:44:48 PM
Description of request	This is a request to create a specialization for the Physics BS degree in Nanoscience with the goal of increasing opportunities for graduate school and jobs for UF Physics majors. The course work for this new specialization consists of all courses in the present Physics BS degree including a specific choice of Physics Electives, plus three additional elective courses outside of Physics. This is on of three applied physics specializations being proposed simultaneously: Medical Physics, Nanoscience, and Optics.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	CLAS - Physics 011616003	J Ingersent		4/22/2019
MSEConsult.pdf EEConsult.pdf CommentConsultsNS.pdf					4/12/2019 4/12/2019 4/12/2019
College	Approved	CLAS - College of Liberal Arts and Sciences	Joseph Spillane		10/14/2019
No document changes					
Associate Provost for Undergraduate Affairs	Approved	PV - Associate Provost for Undergraduate Affairs	Casey Griffith		10/15/2019
No document changes					
University Curriculum Committee	Commented	PV - University Curriculum Committee (UCC)	Lee Morrison	Added to the November agenda. If approved, this will go into effect for the Summer B 2020 term with the publication of the 2020-2021 undergraduate catalog.	11/4/2019
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			11/4/2019
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Specialization|New for request 13848

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Submitter: Selman Hershfield selman@phys.ufl.edu
Created: 4/12/2019 12:10:11 PM
Form version: 1

Responses

Degree Program Physics
CIP Code 40.0801
Major Name Physics
Major Code PS
Degree Type BS
Existing Specializations None, although this is one of three specializations being submitted now.
Name of Proposed Specialization Nanoscience
Code(s) NS
Credits 120
Students 9 (3 per year)
Effective Term Earliest Available
Effective Year Earliest Available
Percentage of Credits Available Fully Online <50%
Percentage of Credits Available Off-Campus <25%
Rationale for Proposed Specialization This is one of three specializations being proposed for the BS degree in Physics to enhance the opportunities for Physics majors for both applying to graduate schools and employment after graduating. Increasingly students are going to college not just to study a field that they are interested in, but also to open up career paths. Discussions with our Physics majors show that there is interest in applied physics specializatons for precisely this reason.

Many of our Physics majors finish most of the required Physics courses in three years. This leaves room for additional courses. Thus, many of our Physics majors are double majors with the most popular options being Mathematics and Astronomy. This was not always the case, but we now find that most students in our major come to UF having already taken some Calculus and Physics in high school. The applied physics specializations provide another option for students that may be particularly attractive because only about one third of Physics majors actually go on to graduate school in Physics. The most common options for those not continuing on in Physics are to go to graduate school in a related field like engineering or in our present job market enter the workforce.

The Nanoscience specialization is also consistent with the intellectual focus of the Physics department. Cutting edge science and cutting edge technology often go hand in hand. Within our own department Prof. Andrew Rinzler was chosen for the National Academy of Inventors for his work on carbon nanotube transistors.

Most of the schools in our peer group of top 10 public universities have some form of applied physics degree which is similar to what we are proposing. The proposed specializations consists of all the courses in our present Physics BS degree plus a specific set of a electives based on specializations in Nanoscience, Optics, or Medical Physics. This is a brief survey of what other top 10 public universities are doing. Keep in mind that each school has a different title for these degrees, concentrations, or specializations, but when you look at the course work it is consistent with what we are doing.

* The University of California, Berkeley has an Engineering Physics degree which closely tracks our Nanoscience option.

* The University of Michigan has an undergraduate Engineering Physics degree, which follows the model proposed here of the Physics major curriculum plus select electives outside the Physics department.

* The University of North Carolina has an entire Applied Sciences degree program which will start awarding degrees in 2023.

* The University of California at Irvine offers an Applied Physics degree with a specialization in Engineering Physics.

* Georgia Tech. offers an Applied Physics degree, but does not spell out specific electives.

* William and Mary has an Engineering Physics and Applied Design degree, which just started this past year.

* The University of California, Davis offers an Applied Physics degree with specializations in computation, physical electronics, geophsysics, materials, and oceanography.

Finally, we note that our Applied Physics degree is not the same as an engineering degree. Students receiving an Applied Physics degree will have all the background in fundamental physics of the regular Physics BS degree plus a few more applied courses to help them in their future career. An engineering degree will have fewer fundamental Physics courses, but many more applied courses.

Most of the schools in our peer group of top 10 public universities have some form of applied physics specialization which is similar to what we are proposing. The nanoscience specialization proposed here consists of all the courses in our present Physics BS degree plus a specific set of a electives described below. Below is a brief survey of what other top 10 public universities are doing relating to applied physics specializations and degrees. Keep in mind that each school has slightly different terminology for these degrees, but when you look at the course options, they are quite similar to our specialization proposals.

* The University of California, Berkeley has an Engineering Physics degree which closely tracks our Nanoscience option.

* The University of Michigan has an undergraduate Engineering Physics degree, which follows the model proposed here of the Physics major curriculum plus select electives outside the Physics department.

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* The University of California, Davis offers an Applied Physics degree with specializations in computation, physical electronics, geophsysics, materials, and oceanography.

Finally, we note that this specialization within the Physics BS major is not the same as an engineering degree. Students receiving a Physics BS degre with this specialization will have all the background in fundamental physics of the regular Physics BS degree plus a few more applied courses to help them in their future career. An engineering degree will have fewer fundamental Physics courses, but many more applied courses.
Impacts on Other Programs The number of undergraduate Physics majors graduating per year is 35-40. We expect that approximately 3 of these students will opt for the specialization in Nanoscience.

Physics Bachelor of Science Specialization in Nanoscience

The Physics B.S. specialization in Nanoscience requires a minimum of 41 credits in Physics including a specific Physics elective, 3 specific courses outside of Physics (9-11 credits), and 28 other credits of related coursework. Minimum grades of C are required for coursework counted toward the major. The coursework is listed below in three different categories: Physics Required Coursework, Required Electives for the Nanoscience specialization, and Related Coursework required for all Physics B.S. degrees.

Required Coursework

Highlighed courses are those for the Nanoscience specialization.

PHY 2048 Physics with Calculus 1 or

60 Enriched Physics with Calculus 1 (3 credits)

PHY 2048L Physics with Calculus 1 Laboratory (1 credit)

PHY 2049 Physics with Calculus 2 or

61 Enriched Physics with Calculus 2 (3 credits)

PHY 2049L Physics with Calculus 2 Laboratory (1 credit)

PHY 3101 Introduction to Modern Physics or

63 Enriched Modern Physics (3 credits)

PHY 3221 Mechanics 1 or

13 Introduction to Theoretical Physics (3 credits)

PHY 3323 Electromagnetism 1 (3 credits)

PHY 3513 Thermal Physics 1 (3 credits)

PHY 4222 Mechanics 2 (3 credits)

PHY 4324 Electromagnetism 1 (3 credits)

PHY 4523 Statistical Physics (3 credits)

PHY 4604 Introductory Quantum Mechanics 1 (3 credits)

PHY 4802L Laboratory Physics 1 (3 credits)

PHY 4803L Laboratory Physics 2 (3 credits)

Physics elective (3 credits): PHZ 4404 Solid State Physics for Nanoscience specialization

Required Courses Outside of Physics – Nanoscience specialization

EEE 3396C - Solid State Electronic Devices (4 credits)

EEE 4331 - Microelectonic Fabrication Technologies (3 credits) or

614 - Production of Electronic Materials (3 credits)

EEL 4222 - Resonant MEMS (3 credits) or

615 - Compound Semiconductors (3 credits) or

353C - Fluid Mechanics (4 credits) or

930 - Plasma Physics (3 credits)

Related Coursework

Three semesters of Calculus (MAC 2311, MAC 2312, MAC 2313; 12 credits)

One year of college-level general chemistry, including one chemistry laboratory course (CHM 2045 and CHM 2046, CHM 2045L; 7 credits)

Differential Equations MAP 2302 (3 credits)

Six credits minimum in approved math courses beyond MAP 2302 Differential Equations.

Certain computer science courses may substitute for one of the math electives.

Minimum grades of C for coursework counted toward the major

Recommended Semester Plan

This plan is structured for students taking Calculus 1 the first semester. Students can have different schedules when they enter UF because of their backgrounds. In particular, students are encouraged to take Physics with Calculus 1 (PHY 2048 or PHY 2060) as soon as they have completed Calculus 1, even if this means delaying chemistry. For all physics courses, adequate mathematical preparation is essential and is built into the suggested plans. Physics majors should meet with a department advisor before planning their schedules.
Additional sample schedules are available from the department and students can email advisors at advising@phys.ufl.edu .
Students are expected to complete the writing requirement while in the process of taking the courses below. Students are also expected to complete the general education international (GE-N) and diversity (GE-D) requirements concurrently with another general education requirement (typically, GE-C, H or S).

Nanoscience specialization

CHM 2045 and 2045L General Chemistry 1 (3) and General Chemistry 1 Laboratory (1) (**Critical Tracking** ; State Core Gen. Ed. I Sciences)
MAC 2311 Analytic Geometry and Calculus 1 (**Critical Tracking** ; State Core Gen. Ed. Mathematics)
State Core Gen. Ed. Composition; Writing Requirement
State Core Gen. Ed. Social and Behavioral Sciences
CHM 2046 General Chemistry 2 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
IDS 1161 What is the Good Life (Gen. Ed. Humanities)
MAC 2312 Analytic Geometry and Calculus 2 (**Critical Tracking** ; State Core Gen. Ed. Mathematics)
PHY 2048 Physics with Calculus 1 or PHY 2060 Enriched Physics with Calculus 1 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
PHY 2048L Physics with Calculus 1 Laboratory (**Critical Tracking** ; Gen. Ed. Physical Sciences)
Elective
MAC 2313 Analytic Geometry and Calculus 3 (**Critical Tracking** ; Gen. Ed. Mathematics)
PHY 2049 Physics with Calculus 2 or PHY 2061 Enriched Physics with Calculus 2 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
PHY 2049L Physics with Calculus 2 Laboratory (**Critical Tracking** ; Gen. Ed. Physical Sciences)
Gen. Ed. Biological Sciences
Foreign language course
MAP 2302 Elementary Differential Equations (**Critical Tracking** ; Gen. Ed. Mathematics)
PHY 3101 Introduction to Modern Physics (**Critical Tracking** ; Gen. Ed. Physical Sciences)
Gen. Ed. Biological Sciences
PHY 3221 Mechanics 1 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
Foreign language course
PHY 3323 Electromagnetism 1 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
PHY 3513 Thermal Physics 1 (**Critical Tracking** ; Gen. Ed. Physical Sciences)
PHY 4222 Mechanics 2 (**Critical Tracking**)
Elective or foreign language if 4-3-3 option
Gen. E. Social and Behavioral Sciences
PHY 4324 Electromagnetism 2 (**Critical Tracking**)
EEE 3396C Solid State Electronic Devices (**Critical Tracking**)

EEE 3303C Solid State Electronic Devices (**Critical Tracking**)
Composition (ENC 3254 Professional Writing in the Discipline recommended; Gen. Ed. Composition; Writing Requirement)
State Core Gen. Ed. Humanities
Mathematics elective
PHY 4604 Introductory Quantum Mechanics 1 (**Critical Tracking**)
PHY 4802L Laboratory Physics 1 (**Critical Tracking**)
EEE 4331 Microelectronic Fabrication Technologies or EMA 4614 Production of Electronic Materials (**Critical Tracking**)
Gen. Ed. Social and Behavioral Sciences
Mathematics elective
PHY 4523 Statistical Physics (**Critical Tracking**)
PHY 4803L Laboratory Physics 2 (**Critical Tracking**)
PHZ 4404 Solid State Physics (**Critical Tracking**)
EMA 4615 - Compound Semiconductors or 3C - Fluid Mechanics or) - Plasma Physics or 2 - Resonant MEMS (**Critical Tracking**)
Gen. Ed. Humanities

Critical Tracking

The following is the new 8 semester tracking plan for the Physics BS degree with the additional tracking requirements for the Nanoscience specialization highlighted.

Semester 1

- Complete CHM 1025 or CHM 2045 ; or PHY 2048 or PHY 2060 ; and a MAC course with C or better
- 2.0 UF GPA required

Semester 2

- Complete CHM 2045 / CHM 2045L and MAC 2311 with C or better
- 2.0 UF GPA required

Semester 3

- Complete CHM 2046 , MAC 2312 , and PHY 2048 or PHY 2060 with C or better
- 2.0 UF GPA required

Semester 4

- Complete MAC 2313 ; and PHY 2049 or PHY 2061 with C or better
- 2.5 critical-tracking GPA
- 2.0 UF GPA required

- 2.0 UF GPA required

Semester 5

- Complete MAP 2302 with C or better (critical tracking)
- 2.5 critical-tracking GPA required
- Complete two 3000-level physics courses required for Physics Majors with C or better (upper division tracking).
- 2.0 UF GPA required

Semester 6

- Complete the remaining 3000-level physics courses required for Physics Majors with C or better.
- Complete one of four courses required for the Nanoscience specialization.
- 2.0 UF GPA required

Semester 7

- Complete PHY4802L or PHY4803L
- Complete two 4000-level physics courses required for Physics Majors with C or better in addition to PHY4802L.
- Complete two of four courses required for the Nanoscience specialization.
- 2.0 UF GPA required

Semester 8

- Complete the remaining 4000-level physics courses required for Physics Majors with C or better.
- Complete one 4000-level or higher Physics Elective with C or better.
- Complete all four courses required for the Nanoscience specialization.
- 2.0 UF GPA required

External Consults

We have done external consults with those departments that overlap most strongly with the proposed Physics BS specialization in Nanoscience: Electrical and Computer Engineering and Materials Science and Engineering. They were both supportive of this specialization, and they have made specific recommendations. We have included their feedback in our final submission:

- Materials Science and Engineering suggested the two upper level courses, EMA 4614 and EMA 4615, that we include in the Nanoscience Option. We removed another Materials Science course that has experienced particularly large enrollments recently so as not to burden their department.

- Electrical and Computer Engineering suggesteed the course EEL 4930 Plasma Physics, which we have included in our Nanoscience Option. They also suggested their course on Lightning, which does not fit the Nanoscience theme. Although they comment that EEE 3396C Solid State Electronic Devices is a more elementary course, it is our opinion that the material in this course will be new to Physics majors and we have kept that class.

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UCC: External Consultations

External Consultation Results (departments with potential overlap or interest in proposed course, if any)

Department	Name and Title
Phone Number	E-mail
Comments	

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Comments	

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