

**DATE:** January 31, 2020

**SUBJECT:** New Academic Program  
University of Memphis  
Applied Physics, PhD  
(CIP 14.1201 – Engineering Physics)

**ACTION RECOMMENDED:** Approval

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**PROGRAM DESCRIPTION**

The University of Memphis proposes an Applied Physics, PhD program that is designed to prepare graduates with advanced skills that fulfill the workforce needs in high-tech industry, government, and education. Applied physicists conduct physics research to develop new technologies and solve engineering problems. The proposed PhD program has been carefully designed to provide a high-level of research experience and academic training to students. The proposed Applied Physics, PhD program will be in the Department of Physics and Material Science that is a high research activity department with excellent faculty, research labs, and a track record of research in applied physics and educational achievements. The Department currently offers both Baccalaureate and Master’s programs in Physics.

The University of Memphis has formulated a strategic plan to enhance research and achieve the Carnegie Classification of Research One (R1) Doctoral University. A survey of active research universities in the United States revealed that every R1 university offered a PhD program in Physics or Applied Physics. The proposed Applied Physics, PhD program will greatly strengthen the University’s position in achieving this goal. Due to the interdisciplinary nature of Applied Physics, the proposed PhD program will enhance research collaboration among various departments including Computer Science, Mathematics, Biological Sciences, Electrical Engineering and Mechanical Engineering.

**INSTITUTIONAL GOVERNING BOARD APPROVAL**

The proposed Applied Physics, PhD program was approved by the University of Memphis Board of Trustees on June 5, 2019.

**PROPOSED IMPLEMENTATION DATE**

Fall 2020

## **RELEVANCE TO INSTITUTIONAL MISSION AND STRATEGIC PLAN**

The proposed Applied Physics, PhD program aligns with the University of Memphis' vision statement: "The University of Memphis is an internationally recognized, urban research university preparing students for success in a diverse, innovative, global environment." The Department of Physics and Material Sciences strives to provide students with a stimulating academic and research environment. Students in this doctoral program will be provided high-level research and academic training.

The proposed program aligns with the 2015-25 Master Plan for Tennessee Postsecondary Education and will fill the current void in Applied Physics in the State of Tennessee by offering an advanced degree in this field. The doctoral program will emphasize the skills of applied physicists that are particularly needed by industries such as biomedical materials and devices, medical technology, manufacturing, logistics, transportation and nanotechnology.

## **CURRICULUM**

The proposed Applied Physics, PhD program requires the completion of 72 credit hours beyond the bachelor's degree or 42 credit hours beyond the master's degree. Students entering with a bachelor's degree will be able to apply up to 36 credit hours of dissertation credit and students entering with a master's degree can apply up to 30 credit hours of dissertation credit. All students will take core classes along with focus and elective courses from other disciplines. The curriculum is structured to support the student's research interest and to ultimately guide the student with their dissertation research. The doctoral program requires students to successfully pass three examinations: qualifying examination, comprehensive examination, and the dissertation defense.

## **PROGRAM PRODUCTIVITY**

The proposed Applied Physics, PhD program projects an initial enrollment of 10 students with steady increases to 28 students by the seventh year. The majority of students will be full-time and supported with graduate assistantships.

Degree completion for the proposed Applied Physics, PhD program will vary based on whether students enter with a bachelor's or master's degree. Students with a bachelor's degree may need 4-6 years and master's students may need 3-5 years to complete the doctoral program.

	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>	<b>2025</b>	<b>2026</b>
<b>Enrollment</b>	10	18	23	25	26	27	28
<b>Assistantships</b>	9	17	22	23	24	25	26
<b>Graduates</b>	--	--	--	3	4	5	5

## **PROGRAM DUPLICATION**

The proposed PhD degree in Applied Physics will be the first such program in the State of Tennessee. Other similar programs offered in Tennessee are at the University of Tennessee, Knoxville (PhD in Physics) and Vanderbilt University (PhD in Physics and Astrophysics).

## **EXTERNAL JUDGEMENT**

An external review of the proposed program was conducted during an institutional site visit on December 12-13, 2019. Dr. Saikat Talapatra, Professor of Physics and Interim Chair at Southern Illinois University at Carbondale and Dr. J. Ping Liu, Distinguished Professor of Physics at the University of Texas at Arlington served as the external reviewers. The site visit included meetings with campus administrators, faculty, students, industry partners and visits to faculty research labs. Dr. Talapatra and Dr. Liu made a joint recommendation for the approval of the program and stated “the proposed program has all the ingredients needed for its successful implementation. First and foremost, it aligns well with the vision of the institution as well as the state. Other strengths include a very sophisticated curriculum backed by state-of-the-art facilities and resources. Experienced educators and researchers will meet the proposed educational goals of the program and as such, it is expected that the training of students enrolled in this program will be top class.”

## **STUDENT DEMAND**

One of the challenges faced by the Department of Physics and Materials Science at the University of Memphis is the lack of a doctoral program. The majority of graduate students have consistently expressed their desire to continue their education with an Applied Physics PhD degree at the University of Memphis. Since the doctoral program did not exist, during the last few years, more than 25 master’s students have left the University of Memphis to pursue PhD programs at other institutions.

The University of Memphis conducted an online survey to determine student interest for an Applied Physics PhD program. The survey was administered to current students and alumni. Among respondents, 77 percent indicated an interest in the proposed doctoral program. Additionally, 99 percent of the respondents agreed that a PhD program in Applied Physics would improve the university’s reputation and research productivity.

## **OPPORTUNITIES FOR PROGRAM GRADUATES**

The United States Department of Labor estimates that during 2016-26, the number of jobs for physics PhDs will increase by 14 percent, which is 7 percent higher than the average growth rate for all occupations. Additionally, according to the data from the Bureau of Labor Statistics, the employment of physicists in Tennessee has doubled in the last two years, from 220 in May 2016 to 440 in May 2018.

The need for the proposed Applied Physics PhD program is corroborated by letters of support from Oak Ridge National Laboratories, Vanderbilt University, Case Western University, Memphis University School, St. Jude Children's Research Hospital, Wright Medical, Memphis Bioworks Foundation, and Smith & Nephew.

### **INSTITUTIONAL CAPACITY TO DELIVER THE PROGRAM**

The proposed Applied Physics PhD program will have a significant impact on the overall capacity at the University of Memphis by enhancing its capability in sponsored research, graduate education, and community engagement. The proposed program will be housed in the Department of Physics and Material Sciences (DPMS) within the College of Arts and Sciences. Currently, this academic unit offers both an undergraduate and Master's degree in Physics. The department has nine tenured and tenure-track faculty members along with one unfilled tenure-track position that will be filled by fall 2020. One of the strengths of the department is the uniquely qualified research faculty with internationally recognized expertise in nanotechnology and computational physics. Over the past five years, faculty have received over \$12 million in external grants with over 400 publications and presentations. The proposed program will also benefit from the exceptional research laboratories.

Appendix A outlines the 7 year financial projections for the Applied Physics PhD program. The majority of expenditures are to support graduate assistantships with stipends and tuition. Graduate assistants will be supported by external funds as well as funding from the University's Division of Research and Innovation. One-time funds will be needed to renovate space for graduate assistants' offices.

### **ASSESSMENT AND POST-APPROVAL MONITORING**

An annual performance review of the proposed program will be conducted for the first seven years following program approval. The review will be based on benchmarks established in the approved proposal. At the end of this period, the campus, institutional governing board, and Commission staff will perform a summative evaluation. The benchmarks include, but are not limited to, enrollment and graduation, program cost, progress toward accreditation, and other metrics set by the institution and Commission staff. If benchmarks are not met during the monitoring period, the Commission may recommend that the institutional governing board terminate the program. If additional time is needed and requested by the institutional governing board, the Commission may choose to extend the monitoring period.

**Attachment A: THEC Financial Projections**  
**University of Memphis**  
**PhD Program in Applied Physics**

Seven-year projections are required for doctoral programs.  
 Five-year projections are required for baccalaureate and Master's degree programs  
 Three-year projections are required for associate degrees and undergraduate certificates. Projections should include cost of living increases per year.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
<b>I. Expenditures</b>							
<b>A. One-time Expenditures</b>							
New/Renovated Space (GA office)	\$ 20,000	\$ 20,000	\$ 20,000	\$ -	\$ -	\$ -	\$ -
Equipment	-	-	-	-	-	-	-
Library	-	-	-	-	-	-	-
Consultants	-	-	-	-	-	-	-
Travel	-	-	-	-	-	-	-
Other (website)	5,000	-	-	-	-	-	-
<b>Sub-Total One-time</b>	\$ 25,000	\$ 20,000	\$ 20,000	-	-	-	-
<b>B. Recurring Expenditures</b>							
<b>Personnel</b>							
<b>Administration</b>							
Salary	-	-	-	-	-	-	-
Benefits	-	-	-	-	-	-	-
<b>Sub-Total Administration</b>	-	-	-	-	-	-	-
<b>Faculty</b>							
Salary	-	-	-	-	-	-	-
Benefits (37.1%)	-	-	-	-	-	-	-
<b>Sub-Total Faculty</b>	-	-	-	-	-	-	-
<b>Support Staff</b>							
Salary	-	-	-	-	-	-	-
Benefits	-	-	-	-	-	-	-

<b>Sub-Total Support Staff</b>	-	-	-	-	-	-	-
<b>Graduate Assistants</b>							
Salary	144,000	272,000	352,000	368,000	384,000	400,000	416,000
Benefits (1.6%)	2,304	4,352	5,632	5,888	6,144	6,400	6,656
Tuition and Fees* (See Below)	96,273	185,486	244,841	261,090	277,891	295,259	313,211
<b>Sub-Total Graduate Assistants</b>	<b>242,577</b>	<b>461,828</b>	<b>602,473</b>	<b>634,978</b>	<b>668,035</b>	<b>701,659</b>	<b>735,867</b>
<b>Operating</b>							
Travel	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Printing	-	-	-	-	-	-	-
Equipment	-	-	-	-	-	-	-
Other (marketing & Advertising)	5,000	3,000	3,000	1,500	1,500	1,500	1,500
<b>Sub-Total Operating</b>	<b>10,000</b>	<b>8,000</b>	<b>8,000</b>	<b>6,500</b>	<b>6,500</b>	<b>6,500</b>	<b>6,500</b>
<b>Total Recurring</b>	<b>252,577</b>	<b>469,838</b>	<b>610,473</b>	<b>641,478</b>	<b>674,535</b>	<b>708,159</b>	<b>742,367</b>
<b>TOTAL EXPENDITURES (A + B)</b>	<b>277,577</b>	<b>489,838</b>	<b>630,473</b>	<b>641,478</b>	<b>674,535</b>	<b>708,159</b>	<b>742,367</b>

**\*If tuition and fees for Graduate Assistants are included, please provide the following information.**

Base Tuition and Fees Rate	10,697.00	10,910.94	11,129.16	11,351.74	11,578.78	11,810.35	12,046.56
Number of Graduate	9	17	22	23	24	25	26

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
<b>II. Revenue</b>							
Tuition and Fees <sup>1</sup>	\$ 7,173	\$ 7,274	\$ 7,419	\$ 15,136	\$ 15,438	\$ 15,747	\$ 16,062
Institutional Reallocations <sup>2</sup>	76,718	208,337	281,318	281,655	304,030	316,960	322,459
Federal Grants <sup>3</sup>	12,827	22,726	32,581	34,864	44,562	148,452	176,846
Private Grants or Gifts <sup>4</sup>	-	-	-	-	-	-	-
Other <sup>5</sup>	180,859	251,501	309,155	309,823	310,505	227,000	227,000
<b>BALANCED BUDGET LINE</b>	<b>\$ 277,577</b>	<b>\$ 489,838</b>	<b>\$ 630,473</b>	<b>\$ 641,478</b>	<b>\$ 674,535</b>	<b>\$ 708,159</b>	<b>\$ 742,367</b>

**(1) In what year is tuition and fee revenue expected to be generated and explain any differential fees. Tuition and fees include maintenance fees, out-of-state tuition, and any applicable earmarked fees for the program.**

Tuition and fee revenue will begin year 1. The projected tuition and fees revenue will be from self-supported part-time students. The majority of the PhD students will be full-time graduate assistants, whose tuition and fees are covered by the graduate assistantships and not reflected in the revenue.

**(2) Please identify the source(s) of the institutional reallocations, and grant matching requirements if applicable.**

Income generated from undergraduate and indirect charges of research grants. This budget will increase gradually up to \$322,459 in the 7<sup>th</sup> year.

**(3) Please provide the source(s) of the Federal Grant including the granting department and CFDA (Catalog of Federal Domestic Assistance) number.**

A federal grant from National Science Foundation (NSF), Math and Physical Science Division (CFDA 47.049)

National Aeronautics and Space Administration (NASA), 43.001

Department of Health and Human Services, NIH 93.310

Department of Energy, 81.117

**(4) Please provide the name of the organization(s) or individual(s) providing grant(s) or gift(s).**

N/A

**(5) Please provide information regarding other sources of the funding.**

The Department of Physics and Materials Science currently has an annual graduate assistantship of 227,000 for MS program, which will phase in to support the PhD program. During year one and two, \$100K and \$170K will be used to support PhD students. From third year, total GA funds of \$227,000 will be shifted to PhD program.

Three PhD students in the first cohort will be supported by First Generation STEM Fellowships from the Division of Research and Innovation (Office of Vice President for Research and Innovation), which amounts to \$80,859 in year one with a slight increase to \$83,505 in year 5. These three GAs are expected to continue in the sixth and seventh years using the Federal Grants, First Generation STEM Fellowships, Diversity Funds, and RISE Fellowship program.