THEORETICAL PHYSICS AND APPLIED MATHEMATICS (BS)

The laws and theories of modern physics are formulated in the language of modern mathematics. In the past, students wishing to study the basic physical laws governing our universe might have gotten away with proficiency in multivariable calculus; but no longer. Since the advent of statistical mechanics, quantum mechanics, and the like, a solid foundation in analysis, abstract algebra, and statistics is also essential. Students pursuing a B.S. in Theoretical Physics and Applied Mathematics with gain exposure to these modern physical theories and to the abstract mathematics underpinning them. Graduating students will be well-prepared for advanced degrees in applied mathematics, physics, or engineering.

Related Programs

Major

- Mathematics (BS) (https://catalog.luc.edu/undergraduate/arts-sciences/mathematics-statistics/mathematics-bs/)

Combined

- Theoretical Physics and Applied Mathematics/Applied Statistics (BS/MS) (https://catalog.luc.edu/undergraduate/accelerated-bachelors-masters-program/theoretical-physics-applied-mathematics-bs-applied-statistics-ms/)
- Theoretical Physics and Applied Mathematics/Mathematics (BS/MS) (https://catalog.luc.edu/undergraduate/accelerated-bachelors-masters-program/theoretical-physics-applied-mathematics-bs-mathematics-ms/)

Curriculum

AP Credit Policies (https://catalog.luc.edu/undergraduate/arts-sciences/mathematics-statistics/#policiestext)

Code	Title	Hours
Mathematics Course Requirements		
MATH 161	Calculus I	4
MATH 162	Calculus II	4
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
MATH 212	Linear Algebra	3
MATH 263	Multivariable Calculus	4
MATH 264	Ordinary Differential Equations	3
MATH 313	Abstract Algebra	3
MATH 351	Introduction to Real Analysis I	3
MATH 353	Introductory Complex Analysis	3
PHYS 130	Introduction to Computational Physics	3
or MATH 215	Object-Oriented Programming with Mathematics	
Physics Course Requirements		
PHYS 121	College Physics I with Calculus Lecture/ Discussion	3
PHYS 111L	College Physics Laboratory I	1
PHYS 122	College Physics II with Calculus Lecture/ Discussion	3
PHYS 112L	College Physics Lab II	1
PHYS 126F	Freshman Projects	1
PHYS 235	Modern Physics	3
PHYS 235L	Modern Physics Laboratory	1
PHYS 301	Mathematical Methods in Physics	3
PHYS 314	Theoretical Mechanics I	3
PHYS 351	Electricity and Magnetism I	3
PHYS 328	Thermal Physical & Statistical Mechanics	3
PHYS 338	Advanced Physics Laboratory	2
PHYS 361	Quantum Mechanics I	3
Total Hours		**63**

Suggested Sequence of Courses

The below sequence of courses is meant to be used as a suggested path for completing coursework. An individual student's completion of requirements depends on course offerings in a given term as well as the start term for a major or graduate study. Students should consult their advisor for assistance with course selection.

Course	Title	Hours
First Year		
Fall		
PHYS 121	College Physics I with Calculus Lecture/ Discussion	3
PHYS 111L	College Physics Laboratory I	1
MATH 161	Calculus I	4
UCWR 110	Writing Responsibly	3
Core		3
	Hours	**14**
Spring		
PHYS 122	College Physics II with Calculus Lecture/ Discussion	3
PHYS 112L	College Physics Lab II	1
PHYS 126F	Freshman Projects	1
MATH 162	Calculus II	4
COMP 215 / MATH 215 or PHYS 130	Object Oriented Programming with Mathematics or Introduction to Computational Physics	3
Core		3
	Hours	**15**
Second Year		
Fall		
PHYS 235	Modern Physics	3
PHYS 235L	Modern Physics Laboratory	1
MATH 263	Multivariable Calculus	4
MATH 264	Ordinary Differential Equations	3
Core		3
	Hours	**14**
Spring		
MATH 201	Introduction to Discrete Mathematics & Number Theory	3
MATH 212	Linear Algebra	3
PHYS 314	Theoretical Mechanics I	3
PHYS 301	Mathematical Methods in Physics	3

Core		3
	Hours	**15**
Third Year		
Fall		
PHYS 351	Electricity and Magnetism I	3
MATH 313	Abstract Algebra	3
MATH 351	Introduction to Real Analysis I	3
Core		3
General Elective		3
	Hours	**15**
Spring		
PHYS 361	Quantum Mechanics I	3
Core		3
Core		3
Core		3
General Elective		3
	Hours	**15**
Fourth Year		
Fall		
MATH 353	Introduction to Complex Analysis	3
PHYS 328	Thermal Physical & Statistical Mechanics	3
Core		3
Core		3
Core		3
	Hours	**15**
Spring		
PHYS 338	Advanced Physics Laboratory	2
Core		3
Core		3
General Elective		3
General Elective		3
General Elective		3
	Hours	**17**
	Total Hours	**120**

College of Arts and Sciences Graduation Requirements

All Undergraduate students in the College of Arts and Sciences are required to take two Writing Intensive courses (6 credit hours) as well as complete a foreign language requirement at 102-level or higher (3 credit hours) or a language competency test. More information can be found here (https://www.luc.edu/cas/college-requirements/).

Additional Undergraduate Graduation Requirements

All Undergraduate students are required to complete the University Core, at least one Engaged Learning course, and UNIV 101. SCPS students are not required to take UNIV 101. Nursing students in the Accelerated BSN program are not required to take core or UNIV 101. You can find more information in the University Requirements (https://catalog.luc.edu/undergraduate/university-requirements/) area.

Learning Outcomes

Loyola University Chicago's major in Theoretical Physics / Applied Mathematics is an interdisciplinary program that provides extensive training in both physics and mathematics. It prepares students for graduate study in physics, mathematics, or applied mathematics; careers in fields such as engineering or computer science that value quantitative reasoning and mathematical modeling; or technical training in professions like medicine, dentistry, or law.

Students majoring in Theoretical Physics / Applied Mathematics possess a versatile set of skills that are well-suited to data science, numerical modeling, and quantitative analysis. They may pursue careers in higher education, at research institutes or government labs, or in high-tech industries. Recent majors have gone on to world class graduate programs in fields ranging from physics to neuroscience, and programming jobs at major tech companies.

The course of study for the Theoretical Physics / Applied Mathematics major covers the core classes in the Physics major, provides laboratory experience, and adds a comprehensive mathematics component. Upon completion of this program, students will:

- Exhibit foundational knowledge in both physics and mathematics.
- Be able to develop and interpret mathematical models that provide both quantitative and qualitative understanding of physical systems.
- Possess intermediate level laboratory skills that will serve as a foundation for more advanced training in graduate or professional school.
- Recognize how careful data collection and analysis helps develop or falsify scientific theories.
- Demonstrate effective and ethical decision-making abilities in issues related to the sciences.