

PHYSICS

The Physics Department:

Department website: <https://www.physics.columbia.edu/>

Office location: 704 Pupin Hall

Office contact: 212-854-3366 (Ashley Delphia, Dir. of Academic Administration)

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Undergraduate Administrator: Giuseppina (Joey) Cambareri, gc2019@columbia.edu, 212-854-3348

The Study of Physics

The physics major offers a rigorous preparation in the intellectual developments of modern physics, along with extensive exposure to the mathematical and experimental techniques required to conduct basic and applied research in physics. For the major, the department offers a set of required courses well-suited to prepare students for the most rigorous course of graduate study. These can be supplemented by elective courses in a variety of advanced topics. Although most majors go on to graduate work in physics, the intellectual skills acquired in the study of physics can also provide the basis for work in a variety of other scientific and nonscientific areas.

Research is an extremely important component of the Columbia physics experience. Because the department has a very small student-to-faculty ratio, essentially all physics majors and concentrators engage in experimental, computational, or theoretical research under the close supervision of a faculty member during part, if not all, of their time at Columbia.

Current programs of study include:

The Physics major
The Astrophysics major
The Biophysics major
The Chemical Physics major

The Physics Minor

Student Advising Consulting Advisers

Students should contact the Director of Undergraduate Studies (DUS) for all advising questions and concerns, however please see the information below that describes appropriate advising contacts for the interdisciplinary majors in Astrophysics, Biophysics and Chemical Physics.

For the Physics major and minor: Jeremy Dodd, jrd4@columbia.edu.

For the Astrophysics major: Jeremy Dodd, jrd4@columbia.edu, and students should also consult with the Director of Undergraduate Studies in the Astronomy Department.

For the Biophysics major: students should consult with the Director of Undergraduate Studies for Biophysics in the Biological Sciences Department.

For the Chemical Physics major: students should consult with the Director of Undergraduate Studies in the Chemistry Department.

The Physics DUS typically holds walk-in office hours each week during the academic year (fall and spring semesters), and may be also be contacted by email. For new students, a Physics Department information session is held during NSOP each fall to help students determine which introductory physics sequence is most appropriate for their program of study. Each spring, the Department hosts an Open House, which focuses on the majors offered in the Department but also provides an opportunity to learn more about research opportunities.

For declared Physics and Astrophysics majors, it is recommended that students consult with the Physics DUS at least once per semester.

Enrolling in Classes

The Physics Department offers four introductory physics sequences.

- PHYSUN1201, PHYSUN1202 primarily for premed students;
- PHYSUN1401, PHYSUN1402, PHYSUN1403 primarily for SEAS engineering students;
- PHYSUN1601, PHYSUN1602, PHYSUN2601 primarily for physics, applied physics and physical science majors;
- PHYSUN2801, PHYSUN2802 primarily for physics and applied physics majors who have advanced placement in physics and mathematics.

The department can provide more detailed information about these sequences. Note that there are calculus pre-requisites or co-requisites in most cases. Enrollment in the PHYSUN2801, PHYSUN2802 Accelerated Physics sequence is by placement only. Students who have a score of 5 on AP Calculus BC and a score of at least one 4 and one 5 on the two AP Physics C exams place automatically. Other students should take the placement exam during the NSOP Physics Information Session.

Please note that all of the above sequences start in the fall semester (only) each year, with the addition of just one "off-sequence" (spring, summer) offering of the PHYSUN1201, PHYSUN1202 General Physics sequence for premed students.

Preparing for Graduate Study

A majority of graduating Physics majors pursue graduate study at either the PhD or Masters levels. The Physics major is designed to provide a strong foundation for students who may continue to pursue a PhD. Aside from all of the required courses for the major, students who will pursue graduate study are recommended to take the PHYSGU4003 Advanced Mechanics elective, and they may also choose to take some graduate level courses if they have sufficient preparation.

Coursework Taken Outside of Columbia

Coursework in fulfillment of a major or minor [or special program or concentration] must be taken at Columbia University unless explicitly noted here and/or expressly permitted by the Director of Undergraduate Studies of the program. Exceptions or substitutions permitted by the Director of Undergraduate Studies should be confirmed in writing by email to the student.

Advanced Placement

The department grants 6 credits for a score of 4 or 5 on BOTH the AP Physics 1 and AP Physics 2 exams, but you are not entitled to any exemptions.

The department grants 3 credits for a score of 4 or 5 on the AP Physics C/MECH exam, but you are not entitled to any exemptions. The amount of credit is reduced to 0 if you take PHYSUN 1001, 1201, 1401 or 1601.

The department grants 3 credits for a score of 4 or 5 on the AP Physics C/E&M exam, but you are not entitled to any exemptions. The amount of credit is reduced to 0 if you take PHYSUN 1001, 1202, 1402 or 1602.

AP, IB or A-level Physics credits are not impacted if you take PHYSUN 2801 or 2802.

Students may earn a maximum of 6 credits in Physics.

Barnard College Courses

No Barnard courses are accepted as requirements for the Physics major. For the Astrophysics major, see the requirements for that program in the Bulletin.

Transfer Courses

When students transfer to Columbia from other institutions, their coursework at their previous institution must first be considered by their school in order to be evaluated for degree credit (e.g., to confirm that the courses will count toward the 124 points of credit that every student is required to complete for the B.A. degree). Only after that degree credit is confirmed, departments may consider whether those courses can also be used to fulfill specific degree requirements toward a major or minor [or special program or concentration].

All transfer courses proposed for consideration for the Physics major must be reviewed by the Physics DUS. Students should provide detailed syllabi for review.

Study Abroad Courses

Classes taken abroad through Columbia#led programs (i.e., those administered by Columbia’s Center for Undergraduate Global Engagement and taught by Columbia instructors) are treated as Columbia courses, equivalent to those taken on the Morningside Heights campus. If they are not explicitly listed by the department as fulfilling requirements in the major or minor [or special program or concentration], the DUS will need to confirm that they can be used toward requirements in the major/minor.

Classes taken abroad through other institutions and programs are treated as transfer credit to Columbia, and are subject to the same policies as other transfer courses. There will be a limit on the number of courses taken abroad that can be applied to the major/minor, and they must be approved by the DUS.

Physics and Astrophysics majors who are considering studying abroad should consult with the respective DUSes well in advance, since careful planning is required to make sure that students can complete all required courses.

Summer Courses

Summer courses at Columbia are offered through the School of Professional Studies. Courses taken in a Summer Term may be used toward requirements for the major/minor only as articulated in department/institute/center guidelines or by permission of the Director(s) of Undergraduate Studies. More general policies about

Summer coursework can be found in the Academic Regulations section of this Bulletin. No physics courses currently offered in Summer Term are relevant for the Department’s majors.

Core Curriculum Connections

Students may be interested in course offerings in this department that can be taken in fulfillment of the Science requirement of the Core Curriculum. See the list of approved courses for the requirement in this Bulletin.

Undergraduate Research and Senior Thesis

Information to be added

Department Honors and Prizes

Information to be added

Other Important Information

The department offers a stand-alone one-semester course for nonscience majors, one introductory sequence in physics intended primarily for preprofessional students, and three introductory sequences in physics for engineering and physical science majors. Students are given credit for courses from only one of the different sequence groups.

Mixing courses across the sequences is strongly discouraged; however, physics majors who begin their studies with PHYS UN1401 INTRO TO MECHANICS # THERMO - PHYS UN1402 INTRO ELEC/MAGNETISM # OPTCS should take PHYS UN2601 PHYSICS III:CLASS/QUANTUM WAVE as the third-semester course.

Introductory Sequences

Nonscience Majors:

PHYS UN1001	PHYSICS FOR POETS
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Preprofessional Students:

PHYS UN1201 & PHYS UN1202	GENERAL PHYSICS I and GENERAL PHYSICS II
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Accompanying laboratory course:

PHYS UN1291 & PHYS UN1292	GENERAL PHYSICS I LAB and GENERAL PHYSICS II LABORATORY
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Engineering and Physical Science Majors:

Select one of the following sequences with accompanying laboratory course:

Sequence A:	
PHYS UN1401 & PHYS UN1402 & PHYS UN1403	INTRO TO MECHANICS # THERMO and INTRO ELEC/MAGNETISM # OPTCS and INTRO-CLASSCL # QUANTUM WAVES
Sequence B:	
PHYS UN1601 & PHYS UN1602 & PHYS UN2601	PHYSICS I:MECHANICS/RELATIVITY and PHYSICS II: THERMO, ELEC # MAG and PHYSICS III:CLASS/QUANTUM WAVE
Sequence C:	
PHYS UN2801 & PHYS UN2802	ACCELERATED PHYSICS I and ACCELERATED PHYSICS II

Sequence A is a self-contained group of three courses, while Sequences B and C anticipate more course work in the Physics Department.

Students considering a physics major are strongly encouraged to begin one of these sequences in their first year.

Professors

Igor Aleiner
 Boris Altshuler
 Elena Aprile
 Dmitri Bassov
 Andrei Beloborodov
 Allan Blaer (*emeritus*)
 Gustaaf Brooijmans
 Norman Christ
 Brian Cole
 Frederik Denef
 Richard Friedberg (*Barnard emeritus*)
 Brian Greene (Mathematics)
 Miklos Gyulassy (*emeritus*)
 Charles J. Hailey
 Timothy Halpin-Healy (Barnard)
 Sven Hartmann (*emeritus*)
 Tony Heinz (*emeritus*)
 Emlyn Hughes
 Lam Hui
 Laura Kay (Barnard Astronomy)
 Tsung Dao Lee (*emeritus*)
 Yuri Levin
 Szabolcs Marka
 Robert Mawhinney (Chair)
 Andrew Millis
 Alfred H. Mueller
 Reshmi Mukherjee (Barnard)
 John Parsons
 Aron Pinczuk (Applied Physics)
 Malvin Ruderman
 Frank Sciulli (*emeritus*)
 Michael Shaevitz
 Michael Tuts
 Yasutomo Uemura
 Erick Weinberg
 William Zajc

Associate Professors

Brian Humensky
 Janna Levin (Barnard)
 Brian Metzger
 Alberto Nicolis
 Abhay Pasupathy
 Ozgur Sahin (Biology)
 Tanya Zelevinsky

Assistant Professors

Cory Dean
 Bradley Johnson
 Georgia Karagiorgi
 Rachel Rosen
 Sebastian Will

Senior Lecturer in Discipline

Jeremy Dodd

Adjunct Professor

Morgan May

Lecturer

Burton Budick
 Eric Raymer

On Leave

Amber Miller

Guidance for Undergraduate Students in the Department

Program Planning for all Students

Students who entered Columbia (as first-year students or as transfer students) in or after Fall 2024 may select from a curriculum of majors and minors. The requirements for the Bachelor of Arts degree, and role of majors and minors in those requirements, can be found in the Academic Requirements section of the Bulletin dated the academic year when the student matriculated at Columbia and the Bulletin dated the academic year when the student was a sophomore and declared programs of study.

Students who entered Columbia in or before Fall 2023 may select from a curriculum of majors and minors and concentrations. The requirements for the Bachelor of Arts degree, and the role of majors and minors in those requirements, can be found in the Academic Requirements section of the Bulletin dated the academic year when the student matriculated at Columbia and the Bulletin dated the academic year when the student was a sophomore and declared programs of study.

All students who are considering majoring in Physics or in Astrophysics are strongly encouraged to begin a relevant introductory physics sequence in their first semester. In general, the Physics major may not be completed in fewer than six semesters; most students take seven or eight semesters to satisfy all requirements.

Course Numbering Structure

Course numbers in the Physics Department broadly follow the standard undergraduate schema. Most introductory (first-year) courses are at the 1000- level, with the exception of the PHYSUN2801, PHYSUN2802 Accelerated Physics sequence. The Physics major in particular is rather well-defined in terms of requirements and when they should/could be taken, given necessary pre-requisites and so is rather "sequential". Note that there are two required two-semester sequences: PHYSUN3007, PHYSUN3008 and PHYSGU4021, PHYSGU4022, which in general should be taken in the fall and spring of a given academic year.

Guidance for First-Year Students

All students who are considering majoring in Physics or in Astrophysics are strongly encouraged to begin a relevant introductory physics sequence in their first semester.

The Physics Department offers four introductory physics sequences.

PHYSUN1201, PHYSUN1202 primarily for premed students;

PHYSUN1401, PHYSUN1402, PHYSUN1403 primarily for SEAS engineering students;

PHYSUN1601, PHYSUN1602, PHYSUN2601 primarily for physics, applied physics and physical science majors;

PHYSUN2801, PHYSUN2802 primarily for physics and applied physics majors who have advanced placement in physics and mathematics.

The department can provide more detailed information about these sequences. Note that there are calculus pre-requisites or co-requisites in most cases. Enrollment in the PHYSUN2801, PHYSUN2802 Accelerated Physics sequence is by placement only. Students who have a score of 5 on AP Calculus BC and a score of at least one 4 and one 5 on the two AP Physics C exams place automatically. Other students should take the placement exam during the NSOP Physics Information Session.

Please note that all of the above sequences start in the fall semester (only) each year, with the addition of just one "off-sequence" (spring, summer) offering of the PHYSUN1201, PHYSUN1202 General Physics sequence for premed students.

Guidance for Transfer Students

Information to be added

Undergraduate Programs of Study

Required Coursework for all Programs

All programs of study require completion of at least one of the introductory physics sequences (described below).

Major in Physics

Physics Courses

The major in physics requires a minimum of 41 points in physics courses, including:

Introductory Sequences

Select one of the following sequences:

Sequence A: Students with a limited background in high school physics may elect to take:

PHYS UN1401 & PHYS UN1402 & PHYS UN2601	INTRO TO MECHANICS # THERMO and INTRO ELEC/MAGNETISM # OPTCS and PHYSICS III:CLASS/QUANTUM WAVE
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Sequence B:

PHYS UN1601 & PHYS UN1602 & PHYS UN2601	PHYSICS I:MECHANICS/RELATIVITY and PHYSICS II: THERMO, ELEC # MAG and PHYSICS III:CLASS/QUANTUM WAVE
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Sequence C: Students with advanced preparation in both physics and mathematics may be eligible to take:

PHYS UN2801 & PHYS UN2802	ACCELERATED PHYSICS I and ACCELERATED PHYSICS II
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Core Physics Courses

PHYS UN3003	MECHANICS
PHYS UN3007	ELECTRICITY-MAGNETISM
PHYS UN3008	ELECTROMAGNETIC WAVES # OPTICS
PHYS GU4021	QUANTUM MECHANICS I
PHYS GU4022	QUANTUM MECHANICS II
PHYS GU4023	THERMAL # STATISTICAL PHYSICS

Elective Courses

Select at least six points of the following courses:

PHYS UN3002	From Quarks To the Cosmos: Applications of Modern Physics
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PHYS GU4003	ADVANCED MECHANICS
PHYS GU4011	PARTICLE ASTROPHYS # COSMOLOGY
PHYS GU4018	SOLID STATE PHYSICS
PHYS GU4019	MATHEMATICL METHODS OF PHYSICS
PHYS GU4040	INTRO TO GENERAL RELATIVITY
PHYS GU4050	Introduction to Particle Physics

With the permission of the Director of Undergraduate Studies, 4000- or 6000-level courses offered in this or other science departments

Laboratory Work at the Intermediate Level *

Select one of the following options:

Option 1:

PHYS UN3081	INTERMEDIATE LABORATORY WORK (two semesters)
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PHYS UN3083	ELECTRONICS LABORATORY
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Option 2:

PHYS UN3081	INTERMEDIATE LABORATORY WORK (three semesters)
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Senior Seminar

PHYS UN3072	SEM IN CURRENT RES. PROBLEMS
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* Approved experimental work with a faculty research group may satisfy one semester of the laboratory requirement.

Mathematics Courses

The Mathematics courses required for the major were updated beginning with the 2023-2024 Academic Year. Please contact the DUS with any questions about these requirements.

Required Mathematics courses (6 courses; 19 points):

MATH UN1101	CALCULUS I
MATH UN1102	CALCULUS II
MATH UN1205	ACCELERATED MULTIVARIABLE CALC In place of the 1100 and 1200 numbered courses, students may elect instead to take MATH UN1207 and MATH UN1208. Students may place out of some of these calculus courses, depending on prior preparation.
APMA E2101 or MATH UN2030	INTRO TO APPLIED MATHEMATICS ORDINARY DIFFERENTIAL EQUATIONS
APMA E3101 or MATH UN2010	APPLIED MATH I: LINEAR ALGEBRA LINEAR ALGEBRA
APMA E4204 or MATH UN3007	FUNCTNS OF A COMPLEX VARIABLE COMPLEX VARIABLES

Suggested Mathematics course: APMA E3102 APPLIED MATHEMATICS II: PDE'S.

Major in Astrophysics

For astrophysics requirements please see:

<http://bulletin.columbia.edu/columbia-college/departments-instruction/astronomy/#requirementstext>

Major in Biophysics

For biophysics requirements please see:

<http://bulletin.columbia.edu/columbia-college/departments-instruction/biological-sciences/#requirementstext>

Major in Chemical Physics

For chemical physics requirements please see:

<http://bulletin.columbia.edu/columbia-college/departments-instruction/chemistry/#requirementstext>

Minor in Physics

There are two components to the requirements of the minor. Both need to be satisfied.

1) One of any introductory physics sequences that satisfies the major requirements:

A. Intro Sequence A (9.5pt):

PHYS UN1401 INTRO TO MECHANICS # THERMO 3pt. Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, temperature and heat, gas laws, the first and second laws of thermodynamics.

PHYS UN1402 INTRO ELEC/MAGNETISM # OPTICS 3pt. Electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves, polarization, geometrical optics, interference, and diffraction.

PHYS UN2601 PHYSICS III: CLASS/QUANTUM WAVE, 3.5pt. Classical waves and the wave equation, geometrical optics, interference and diffraction, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, reflection and transmission coefficients, the harmonic oscillator. The course is preparatory for advanced work in physics and related fields.

B. Intro Sequence B (10.5pt):

PHYS UN1601 PHYSICS I: MECHANICS/RELATIVITY, 3.5pt. Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, introduction to special relativity and relativistic kinematics. The course is preparatory for advanced work in physics and related fields.

PHYS UN1602 PHYSICS II: THERMO, ELEC # MAG, 3.5pt. Temperature and heat, gas laws, the first and second laws of thermodynamics, kinetic theory of gases, electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves. The course is preparatory for advanced work in physics and related fields.

PHYS UN2601 PHYSICS III: CLASS/QUANTUM WAVE, 3.5pt. Classical waves and the wave equation, geometrical optics, interference and diffraction, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, reflection and transmission coefficients, the harmonic oscillator. The course is preparatory for advanced work in physics and related fields.

C. Intro Sequence C (9pt):

PHYS UN2801 ACCELERATED PHYSICS I, 4.5pt. This accelerated two-semester sequence covers the subject matter of Intro Sequence B, and is intended for those students who have an exceptionally strong background in both physics and mathematics. The course is preparatory for advanced work in physics and related fields.

PHYS UN2802 ACCELERATED PHYSICS II, 4.5pt. This accelerated two-semester sequence covers the subject matter of Intro Sequence B, and is intended for those students who have an exceptionally strong background in both physics and mathematics. The course is preparatory for advanced work in physics and related fields.

2) Three 3000+ courses that satisfy most combinations of the core major requirements or the elective major requirements 1 so long as appropriate pre-requisite requirements are adhered to.

Students must take any three of the following intermediate level courses provided they adhere to course prerequisites:

1. PHYS UN3003 MECHANICS, 3pt. Newtonian mechanics, oscillations and resonance, conservative forces and potential energy, central forces, non-inertial frames of reference, rigid body motion, an introduction to Lagrange's formulation of mechanics, coupled oscillators, and normal modes
2. PHYS UN3007 ELECTRICITY-MAGNETISM, 3pt. Electrostatics and magnetostatics, Laplace's equation and boundary-value problems, multipole expansions, dielectric and magnetic materials, Faraday's law, AC circuits, Maxwell's equations, Lorentz covariance, and special relativity
3. PHYS UN3008 ELECTROMAGNETIC WAVES # OPTICS, 3pt. Maxwell's equations and electromagnetic potentials, the wave equation, propagation of plane waves, reflection and refraction, geometrical optics, transmission lines, wave guides, resonant cavities, radiation, interference of waves, and diffraction
4. PHYS GU4021 QUANTUM MECHANICS I, 3pt. Formulation of quantum mechanics in terms of state vectors and linear operators. Three dimensional spherically symmetric potentials. The theory of angular momentum and spin. Identical particles and the exclusion principle. Methods of approximation. Multi-electron atoms
5. PHYS GU4022 QUANTUM MECHANICS II, 3pt. Formulation of quantum mechanics in terms of state vectors and linear operators, three-dimensional spherically symmetric potentials, the theory of angular momentum and spin, time-independent and time-dependent perturbation theory, scattering theory, and identical particles. Selected phenomena from atomic physics, nuclear physics, and elementary particle physics are described and then interpreted using quantum mechanical models
6. PHYS GU4023 THERMAL # STATISTICAL PHYSICS, 3pt. Thermodynamics, kinetic theory, and methods of statistical mechanics; energy and entropy; Boltzmann, Fermi, and Bose distributions; ideal and real gases; blackbody radiation; chemical equilibrium; phase transitions; ferromagnetism
7. PHYS GU4003 ADVANCED MECHANICS, 3pt. Lagrange's formulation of mechanics, calculus of variations and the Action Principle, Hamilton's formulation of mechanics, rigid body motion, Euler angles, continuum mechanics, introduction to chaotic dynamics
8. PHYS GU4011 PARTICLE ASTROPHYSICS # COSMOLOGY, 3pt. An introduction to the basics of particle astrophysics and cosmology. Particle physics - introduction to the Standard Model and supersymmetry/higher dimension theories; Cosmology - Friedmann-Robertson-Walker line element and equation for expansion of universe; time evolution of energy/matter density from the Big Bang; inflationary cosmology; microwave background theory and observation; structure formation; dark energy; observational tests of geometry of universe and expansion; observational evidence for dark matter; motivation for existence of dark matter from particle physics; experimental searches of dark matter; evaporating and primordial black holes; ultra-high energy phenomena (gamma-rays and cosmic-rays)
9. PHYS GU4012 STRING THEORY, 3pt. This course is intended as an introduction to string theory for undergraduates. No advanced graduate-level preparation is assumed, and the material will be covered at (no higher than) the advanced undergraduate level. Advanced topics such as supersymmetry, T-duality, and covariant quantization will not be covered. The focus will be on the dynamics of classical and quantum

mechanical strings, with an emphasis on integrating undergraduate material in classical mechanics, relativity, electrodynamics and quantum mechanics.

10. PHYS GU4018 SOLID STATE PHYSICS, 3pt. Introduction to solid-state physics: crystal structures, properties of periodic lattices, electrons in metals, band structure, transport properties, semiconductors, magnetism, and superconductivity

11. PHYS GU4024 Applied Quantum Mechanics, 3pt. Thermodynamics, kinetic theory, and methods of statistical mechanics; energy and entropy; Boltzmann, Fermi, and Bose distributions; ideal and real gases; blackbody radiation; chemical equilibrium; phase transitions; ferromagnetism

12. PHYS GU4040 INTRO TO GENERAL RELATIVITY, 3pt. Tensor algebra, tensor analysis, introduction to Riemann geometry. Motion of particles, fluid, and fields in curved spacetime. Einstein equation. Schwarzschild solution; test-particle orbits and light bending. Introduction to black holes, gravitational waves, and cosmological models

13. PHYS GU4050 Introduction to Particle Physics, 3pt. This course covers the Standard Model of Particle Physics, including its conception, successes, and limitations, with the goal of introducing upper-level physics majors to the foundations and current status of particle physics as a field of research. Specific topics to be covered include: historical introduction and review of the Standard Model; particle interactions and particle dynamics; relativistic kinematics; Feynman calculus, quantum electrodynamics, quantum chromodynamics, and weak interactions; electroweak unification and the Higgs mechanism; neutrino oscillations; and beyond-standard model physics and evidence. Along the way, students will research special topics and familiarize themselves with particle physics research.

For students who entered Columbia in or before the 2023-24 academic year

Concentrations are available to students who entered Columbia in or before Fall 2023. The requirements for the Bachelor of Arts degree, and the role of the concentration in those requirements, can be found in the Academic Requirements section of the Bulletin dated the academic year when the student matriculated at Columbia and the Bulletin dated the academic year when the student was a sophomore and declared programs of study.

Concentrations are not available to students who entered Columbia in or after Fall 2024.

Concentration in Physics

The concentration in physics requires a minimum of 24 points in physics, including one of the introductory sequences.

PHYS UN1001 PHYSICS FOR POETS. 3.00 points. CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: high school algebra.
Prerequisites: high school algebra. This course does not fulfill the physics requirement for admission to medical school. No previous background in physics is expected. An introduction to physics taught through the exploration of the scientific method, and the application of physical principles to a wide range of topics from quantum mechanics to cosmology

Spring 2026: PHYS UN1001					
Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1001	001/13920	T Th 2:40pm - 3:55pm 428 Pupin Laboratories	Szabolcs Marka	3.00	85/130
PHYS 1001	JE1/20738	W 6:00pm - 9:00pm Othr Other	Jeremy Dodd	3.00	18/18

PHYS UN1018 WEAPONS OF MASS DESTRUCTION. 3.00 points. CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: high school science and math.
Prerequisites: high school science and math. A review of the history and environmental consequences of nuclear, chemical, and biological weapons of mass destruction (WMD); of how these weapons work, what they cost, how they have spread, how they might be used, how they are currently controlled by international treaties and domestic legislation, and what issues of policy and technology arise in current debates on WMD. What aspects of the manufacture of WMD are easily addressed, and what aspects are technically challenging? It may be expected that current events/headlines will be discussed in class

Spring 2026: PHYS UN1018					
Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1018	001/13921	T Th 11:40am - 12:55pm 301 Pupin Laboratories	Szabolcs Marka	3.00	50/130

PHYS UN1111 ORIGINS AND MEANING. 3.00 points.

This course is a one-semester journey across cosmological history, from the beginning of time to something akin to its end. We will explore the origin of inanimate physical structures (the cosmos as a whole, as well as that of galaxies, stars, planets, particles, atoms and complex molecules), the origin of life (replicating molecules, the first cells, as well as more complex life forms), the origin of mind (self-reflective conscious awareness) and the origin of culture (language, myth, religion, art, and science). We will then consider what science in particular tells us about the very far future, where we will encounter the likely demise of all complex matter, all life and all consciousness. In the face of such disintegration we will examine the nature of value and purpose. We will recognize that the deepest understanding of reality emerges from blending all of the accounts we discuss—from the reductionist to the humanist to the cosmological—and only through such amalgamation can we fully grasp the long-standing human search for meaning

PHYS UN1151 Origins and Meaning: Independent Study. 1.00 point.

The proposed independent study is a one-semester course that is in dialogue with the Origins and Meaning, Physics UN1111. Students in the independent study will further explore various issues raised in Origins and Meaning by (a) meeting once per week with the instructor, (b) completing a selection of readings and viewings, and (c) completing an end-of-term writing assignment

PHYS UN1201 GENERAL PHYSICS I. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: some basic background in calculus or be concurrently taking *MATH V1101x* Calculus I.

Prerequisites: some basic background in calculus or be concurrently taking MATH UN1101 Calculus I. The accompanying laboratory is PHYS UN1291-UN1292 The course will use elementary concepts from calculus. The accompanying laboratory is PHYS UN1291 - UN1292. Basic introduction to the study of mechanics, fluids, thermodynamics, electricity, magnetism, optics, special relativity, quantum mechanics, atomic physics, and nuclear physics

Spring 2026: PHYS UN1201

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1201	001/13922	M W 4:10pm - 5:25pm 428 Pupin Laboratories	Mark Ross-Lonergan	3.00	92/130

Fall 2026: PHYS UN1201

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1201	001/12356	M W 11:40am - 12:55pm 301 Pupin Laboratories	P. Michael Tuts	3.00	170/170
PHYS 1201	002/12357	T Th 2:40pm - 3:55pm 301 Pupin Laboratories	Eric Raymer	3.00	170/170

PHYS UN1202 GENERAL PHYSICS II. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: *PHYS W1201*, and some background in calculus or be concurrently taking *MATH V1101x* Calculus I.

Prerequisites: This course will use elementary concepts from calculus. Students should therefore have had some high school calculus, or be concurrently enrolled in MATH UN1101. Taken with accompanying lab PHYS UN1291- PHYS UN1292, the sequence PHYS UN1201- PHYS UN1202 satisfies requirements for medical school. Electricity, magnetism, optics, and modern physics

Spring 2026: PHYS UN1202

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1202	001/13923	M W 11:40am - 12:55pm 301 Pupin Laboratories	P. Michael Tuts	3.00	168/170
PHYS 1202	003/13924	T Th 2:40pm - 3:55pm 301 Pupin Laboratories	Jeremy Dodd	3.00	125/170

PHYS UN1203 GENERAL PHYSICS I - REC. 0.00 points.**Spring 2026: PHYS UN1203**

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1203	001/13997	M 6:10pm - 7:00pm 313 Pupin Laboratories	Mark Ross-Lonergan	0.00	21/22
PHYS 1203	002/13998	T 5:10pm - 6:00pm 411 Kent Hall	Mark Ross-Lonergan	0.00	16/22
PHYS 1203	003/13999	T 6:10pm - 7:00pm 425 Pupin Laboratories	Mark Ross-Lonergan	0.00	7/22
PHYS 1203	004/14000	W 6:10pm - 7:00pm 224 Pupin Laboratories	Mark Ross-Lonergan	0.00	20/22
PHYS 1203	006/14002	Th 4:10pm - 5:00pm 411 Kent Hall	Mark Ross-Lonergan	0.00	12/22
PHYS 1203	007/14003	T 4:10pm - 5:00pm 425 Pupin Laboratories	Mark Ross-Lonergan	0.00	16/22

Fall 2026: PHYS UN1203

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1203	001/12387	M 4:10pm - 5:00pm 424 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1203	002/12388	M 5:10pm - 6:00pm 424 Pupin Laboratories	P. Michael Tuts	0.00	15/22
PHYS 1203	003/12389	M 6:10pm - 7:00pm 424 Pupin Laboratories	P. Michael Tuts	0.00	13/22
PHYS 1203	004/12390	T 4:10pm - 5:00pm 255 International Affairs Bldg	P. Michael Tuts	0.00	21/22
PHYS 1203	005/12391	T 5:10pm - 6:00pm 308a Lewisohn Hall	P. Michael Tuts	0.00	10/22
PHYS 1203	006/12392	T 6:10pm - 7:00pm 308a Lewisohn Hall	P. Michael Tuts	0.00	10/22
PHYS 1203	007/12393	W 4:10pm - 5:00pm 705 Pupin Laboratories	P. Michael Tuts	0.00	18/18
PHYS 1203	008/12394	W 5:10pm - 6:00pm 705 Pupin Laboratories	P. Michael Tuts	0.00	5/18
PHYS 1203	011/12395	T 4:10pm - 5:00pm 705 Pupin Laboratories	Eric Raymer	0.00	22/22
PHYS 1203	012/12396	T 5:10pm - 6:00pm 227 Seeley W. Mudd Building	Eric Raymer	0.00	7/22
PHYS 1203	013/12397	T 6:10pm - 7:00pm 325 Pupin Laboratories	Eric Raymer	0.00	6/22
PHYS 1203	014/12398	W 4:10pm - 5:00pm 814 Pupin Laboratories	Eric Raymer	0.00	22/22
PHYS 1203	015/12399	W 5:10pm - 6:00pm 814 Pupin Laboratories	Eric Raymer	0.00	10/22
PHYS 1203	016/12400	W 6:10pm - 7:00pm 308a Lewisohn Hall	Eric Raymer	0.00	16/22
PHYS 1203	017/12401	Th 4:10pm - 5:00pm 224 Pupin Laboratories	Eric Raymer	0.00	21/22
PHYS 1203	018/12402	Th 5:10pm - 6:00pm 224 Pupin Laboratories	Eric Raymer	0.00	7/22

PHYS UN1204 GENERAL PHYSICS II - REC. 0.00 points.

Spring 2026: PHYS UN1204

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1204	001/14004	M 4:10pm - 5:00pm 224 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1204	002/14005	M 5:10pm - 6:00pm 224 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1204	003/14006	M 6:10pm - 7:00pm 224 Pupin Laboratories	P. Michael Tuts	0.00	20/22
PHYS 1204	004/14007	M 7:10pm - 8:00pm 222 Pupin Laboratories	P. Michael Tuts	0.00	11/22
PHYS 1204	005/14008	T 3:10pm - 4:00pm 325 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1204	006/14009	T 4:10pm - 5:00pm 325 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1204	007/14010	T 5:10pm - 6:00pm 325 Pupin Laboratories	P. Michael Tuts	0.00	17/22
PHYS 1204	008/14012	T 6:10pm - 7:00pm 325 Pupin Laboratories	P. Michael Tuts	0.00	22/22
PHYS 1204	009/14011	T 7:10pm - 8:00pm 325 Pupin Laboratories	P. Michael Tuts	0.00	13/22
PHYS 1204	011/14013	W 3:10pm - 4:00pm 304 Hamilton Hall	Jeremy Dodd	0.00	18/22
PHYS 1204	012/14014	W 4:10pm - 5:00pm 224 Pupin Laboratories	Jeremy Dodd	0.00	16/22
PHYS 1204	013/14015	T 5:10pm - 6:00pm 425 Pupin Laboratories	Jeremy Dodd	0.00	21/22
PHYS 1204	014/14017	T 6:10pm - 7:00pm 313 Pupin Laboratories	Jeremy Dodd	0.00	15/22
PHYS 1204	016/14019	M 3:10pm - 4:00pm 424 Pupin Laboratories	Jeremy Dodd	0.00	22/22
PHYS 1204	017/14021	M 4:10pm - 5:00pm 424 Pupin Laboratories	Jeremy Dodd	0.00	13/22
PHYS 1204	019/14020	Th 4:10pm - 5:00pm 212d Lewisohn Hall	Jeremy Dodd	0.00	21/22

PHYS UN1291 GENERAL PHYSICS I LAB. 1.00 point.Same course as *PHYS W1291x*, but given off-sequence.

Corequisites: PHYS UN1201

Corequisites: PHYS UN1201 This course is the laboratory for the corequisite lecture course and can be taken only during the same term as the corresponding lecture

Spring 2026: PHYS UN1291

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1291	002/13958	M 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri, Rebecca Grossman	1.00	14/15
PHYS 1291	003/13959	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri, Rebecca Grossman	1.00	12/15
PHYS 1291	005/13961	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	13/15
PHYS 1291	006/13962	W 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	11/15
PHYS 1291	007/13963	Th 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri, Rebecca Grossman	1.00	12/15
PHYS 1291	008/13964	Th 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	13/15

Fall 2026: PHYS UN1291

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1291	001/13116	M 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	002/13117	M 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	003/13118	M 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	004/13119	M 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	005/13120	M 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	006/13629	T 9:30am - 12:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	007/13121	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	008/13122	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	009/13123	T 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	010/13124	T 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	011/13125	T 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	012/13154	W 9:30am - 12:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	013/13126	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	014/13127	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1291	015/13128	W 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15

PHYS UN1292 GENERAL PHYSICS II LABORATORY. 1.00 point.

Corequisites: PHYS UN1201, PHYS UN1202

Corequisites: PHYS UN1201, PHYS UN1202 This course is the laboratory for the corequisite lecture course (PHYS UN1201 - PHYS UN1202) and can be taken only during the same term as the corresponding lecture

Spring 2026: PHYS UN1292

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1292	001/13965	M 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	13/15
PHYS 1292	002/13966	M 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	003/13967	M 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	004/13968	M 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	12/15
PHYS 1292	005/13969	M 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1292	007/13970	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	008/13971	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	12/15
PHYS 1292	009/13972	T 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	010/13973	T 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	011/13974	T 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	13/15
PHYS 1292	013/13975	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1292	014/13976	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	015/13977	W 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	016/13978	W 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15
PHYS 1292	017/13979	W 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	11/15
PHYS 1292	018/13980	Th 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	13/15
PHYS 1292	020/13982	Th 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	022/13983	Th 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	14/15
PHYS 1292	025/13984	F 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Giuseppina Cambareri	1.00	15/15

PHYS UN1401 INTRO TO MECHANICS # THERMO. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Corequisites: MATH UN1101

Corequisites: MATH UN1101 Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, temperature and heat, gas laws, the first and second laws of thermodynamics. Corequisite: MATH UN1101 or the equivalent

Fall 2026: PHYS UN1401

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1401	001/12358	M W 10:10am - 11:25am 301 Pupin Laboratories	Hector Ochoa	3.00	14/130
PHYS 1401	002/12359	T Th 1:10pm - 2:25pm 301 Pupin Laboratories	James Hill	3.00	8/130
PHYS 1401	003/12360	T Th 10:10am - 11:25am 301 Pupin Laboratories	Jeremy Dodd	3.00	33/130

PHYS UN1402 INTRO ELEC/MAGNETISM # OPTCS. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: PHYS UN1401 *PHYS W1401*.

Corequisites: MATH UN1102

Prerequisites: PHYS W1401. Corequisites: MATH V1102 or the equivalent. Electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves, polarization, geometrical optics, interference, and diffraction

Spring 2026: PHYS UN1402

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1402	001/13925	M W 10:10am - 11:25am 301 Pupin Laboratories	Hector Ochoa	3.00	146/170
PHYS 1402	002/13926	M W 1:10pm - 2:25pm 301 Pupin Laboratories	Charles Hailey	3.00	151/170
PHYS 1402	003/13927	T Th 10:10am - 11:25am 301 Pupin Laboratories	Eric Raymer	3.00	168/170

PHYS UN1403 INTRO-CLASSCL # QUANTUM WAVES. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: PHYS UN1402 *PHYS W1402*.Corequisites: *MATH V1201* or the equivalent.

Prerequisites: PHYS UN1402 *PHYS W1402*. Corequisites: MATH V1201 or the equivalent. Classical waves and the wave equation, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, reflection and transmission coefficients, applications to atomic physics

Fall 2026: PHYS UN1403

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1403	001/12361	M W 1:10pm - 2:25pm 301 Pupin Laboratories	Cory Dean	3.00	173/180

PHYS UN1404 INTRO TO MECH # THERMO - REC. 0.00 points.

Fall 2026: PHYS UN1404

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1404	001/12403	M 4:10pm - 5:00pm 224 Pupin Laboratories	Hector Ochoa	0.00	6/25
PHYS 1404	002/12404	M 5:10pm - 6:00pm 224 Pupin Laboratories	Hector Ochoa	0.00	0/25
PHYS 1404	003/12405	M 6:10pm - 7:00pm 224 Pupin Laboratories	Hector Ochoa	0.00	3/25
PHYS 1404	004/12406	T 4:10pm - 5:00pm 313 Pupin Laboratories	Hector Ochoa	0.00	2/25
PHYS 1404	005/12407	T 5:10pm - 6:00pm 313 Pupin Laboratories	Hector Ochoa	0.00	0/25
PHYS 1404	006/12408	T 6:10pm - 7:00pm 313 Pupin Laboratories	Hector Ochoa	0.00	0/25
PHYS 1404	007/12409	W 4:10pm - 5:00pm Room TBA	Hector Ochoa	0.00	0/25
PHYS 1404	011/12410	T 4:10pm - 5:00pm 329 Uris Hall	James Hill	0.00	1/25
PHYS 1404	012/12411	T 5:10pm - 6:00pm 224 Pupin Laboratories	James Hill	0.00	0/25
PHYS 1404	013/12412	T 6:10pm - 7:00pm 224 Pupin Laboratories	James Hill	0.00	0/25
PHYS 1404	014/12413	W 4:10pm - 5:00pm 224 Pupin Laboratories	James Hill	0.00	1/25
PHYS 1404	015/12414	W 5:10pm - 6:00pm 224 Pupin Laboratories	James Hill	0.00	0/25
PHYS 1404	016/12415	W 6:10pm - 7:00pm 224 Pupin Laboratories	James Hill	0.00	1/25
PHYS 1404	017/12416	Th 4:10pm - 6:50pm 511 Hamilton Hall	James Hill	0.00	0/25
PHYS 1404	021/12417	T 4:10pm - 5:00pm 201a Philosophy Hall	Jeremy Dodd	0.00	3/25
PHYS 1404	022/12418	T 5:10pm - 6:00pm 201a Philosophy Hall	Jeremy Dodd	0.00	0/25
PHYS 1404	023/12419	T 6:10pm - 7:00pm 201a Philosophy Hall	Jeremy Dodd	0.00	3/25
PHYS 1404	024/12420	W 4:10pm - 5:00pm 424 Pupin Laboratories	Jeremy Dodd	0.00	8/25
PHYS 1404	025/12421	W 5:10pm - 6:00pm 424 Pupin Laboratories	Jeremy Dodd	0.00	1/25
PHYS 1404	026/12422	W 6:10pm - 7:00pm 424 Pupin Laboratories	Jeremy Dodd	0.00	0/25
PHYS 1404	027/12423	Th 4:10pm - 5:00pm 304 Uris Hall	Jeremy Dodd	0.00	0/25

PHYS UN1405 INTRO ELEC/MAGNETISM/OPT-REC. 0.00 points.

Spring 2026: PHYS UN1405

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1405	001/14026	M 5:10pm - 6:00pm C01 Knox Hall	Hector Ochoa	0.00	26/27
PHYS 1405	002/14027	M 6:10pm - 7:00pm C01 Knox Hall	Hector Ochoa	0.00	26/27
PHYS 1405	003/14028	T 5:10pm - 6:00pm C01 Knox Hall	Hector Ochoa	0.00	28/27
PHYS 1405	004/14029	T 6:10pm - 7:00pm C01 Knox Hall	Hector Ochoa	0.00	27/27
PHYS 1405	006/14031	W 5:10pm - 6:00pm 467 Ext Schermerhorn Hall	Hector Ochoa	0.00	27/27
PHYS 1405	007/14033	W 6:10pm - 7:00pm C01 Knox Hall	Hector Ochoa	0.00	11/27
PHYS 1405	011/14034	T 4:10pm - 5:00pm C01 Knox Hall	Charles Hailey	0.00	27/27
PHYS 1405	012/14035	T 5:10pm - 6:00pm 301m Fayerweather	Charles Hailey	0.00	26/27
PHYS 1405	013/14036	T 6:10pm - 7:00pm 963 Ext Schermerhorn Hall	Charles Hailey	0.00	19/27
PHYS 1405	014/14037	W 3:10pm - 4:00pm 467 Ext Schermerhorn Hall	Charles Hailey	0.00	25/27
PHYS 1405	015/14038	W 4:10pm - 5:00pm 467 Ext Schermerhorn Hall	Charles Hailey	0.00	25/27
PHYS 1405	016/14039	W 5:10pm - 6:00pm C01 Knox Hall	Charles Hailey	0.00	17/27
PHYS 1405	017/14040	W 6:10pm - 7:00pm 963 Ext Schermerhorn Hall	Charles Hailey	0.00	13/27
PHYS 1405	021/14042	M 4:10pm - 5:00pm C01 Knox Hall	Eric Raymer	0.00	25/27
PHYS 1405	022/14043	M 5:10pm - 6:00pm 467 Ext Schermerhorn Hall	Eric Raymer	0.00	20/27
PHYS 1405	023/14044	T 4:10pm - 5:00pm 644 Seeley W. Mudd Building	Eric Raymer	0.00	26/27
PHYS 1405	024/14045	T 5:10pm - 6:00pm 644 Seeley W. Mudd Building	Eric Raymer	0.00	27/27
PHYS 1405	025/14046	W 4:10pm - 5:00pm 253 International Affairs Bldg	Eric Raymer	0.00	27/27
PHYS 1405	026/14047	W 5:10pm - 6:00pm 253 International Affairs Bldg	Eric Raymer	0.00	18/27
PHYS 1405	027/14048	Th 4:10pm - 5:00pm 332 Uris Hall	Eric Raymer	0.00	27/27

PHYS UN1493 INTRO TO EXPERIMENTAL PHYS-LAB. 3.00 points.**PHYS UN1494 INTRO TO EXPERIMENTAL PHYS-LAB. 3.00 points.**Prerequisites: PHYS UN1401 and PHYS UN1402 *PHYS W1401 and W1402.*

Prerequisites: PHYS W1401 and W1402. Laboratory work associated with the two prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic physics, and nuclear physics. Note: Students cannot receive credit for both PHYS W1493 and W1494

Spring 2026: PHYS UN1494

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1494	003/13987	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	003/13987	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	004/13988	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	004/13988	T 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	005/13989	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	10/15
PHYS 1494	005/13989	T 7:30pm - 10:30pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	10/15
PHYS 1494	006/13990	W 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	13/15
PHYS 1494	006/13990	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	13/15
PHYS 1494	007/13991	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	007/13991	W 4:10pm - 7:10pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	12/15
PHYS 1494	009/13993	Th 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	11/15
PHYS 1494	009/13993	M 2:40pm - 3:55pm 329 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	11/15

Fall 2026: PHYS UN1494

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1494	001/12584	M 2:40pm - 3:55pm 428 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	9/15
PHYS 1494	001/12584	T 9:30am - 12:30pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	9/15
PHYS 1494	002/12585	T 1:00pm - 4:00pm 5th Flr Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	15/15
PHYS 1494	002/12585	M 2:40pm - 3:55pm 428 Pupin Laboratories	Timothy Halpin-Healy, Giuseppina Cambareri	3.00	15/15

PHYS UN1601 PHYSICS I:MECHANICS/RELATIVITY. 3.50 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: Corequisite: MATH UN1102 Calculus II or equivalent. Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, introduction to special relativity and relativistic kinematics. The course is preparatory for advanced work in physics and related fields

Fall 2026: PHYS UN1601

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1601	001/12362	T Th 10:10am - 11:25am 428 Pupin Laboratories	Raquel Quieroz	3.50	18/130

PHYS UN1602 PHYSICS II: THERMO, ELEC # MAG. 3.50 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: PHYS UN1601 *PHYS W1601.*

Prerequisites: PHYS UN1601 Corequisite: MATH UN1201 or equivalent.

Temperature and heat, gas laws, the first and second laws of thermodynamics, kinetic theory of gases, electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves. The course is preparatory for advanced work in physics and related fields

Spring 2026: PHYS UN1602

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1602	001/13928	T Th 10:10am - 11:25am 428 Pupin Laboratories	Kerstin Perez	3.50	106/130

PHYS UN1603 PHYSICS I:MECHANICS/RELATIVITY-REC. 0.00 points.**Fall 2026: PHYS UN1603**

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1603	001/14200	T 4:10pm - 5:25pm 415 Schapiro Cepser	Raquel Quieroz	0.00	3/27
PHYS 1603	002/14201	T 5:40pm - 6:55pm 330 Uris Hall	Raquel Quieroz	0.00	0/27
PHYS 1603	003/14202	W 4:10pm - 5:25pm 141 Uris Hall	Raquel Quieroz	0.00	3/27
PHYS 1603	004/14203	W 5:40pm - 6:55pm 201a Philosophy Hall	Raquel Quieroz	0.00	1/27
PHYS 1603	005/14204	Th 4:10pm - 5:25pm 337 Seeley W. Mudd Building	Raquel Quieroz	0.00	2/27

PHYS UN1604 PHYSICS II:THERMO,ELEC/MAG-REC. 0.00 points.**Spring 2026: PHYS UN1604**

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 1604	001/14050	T 4:10pm - 5:25pm 606 Martin Luther King Building	Kerstin Perez	0.00	29/30
PHYS 1604	003/14052	W 4:10pm - 5:25pm 415 Schapiro Cepser	Kerstin Perez	0.00	30/30
PHYS 1604	004/14053	W 5:40pm - 6:55pm 424 Pupin Laboratories	Kerstin Perez	0.00	25/30
PHYS 1604	005/14055	Th 4:10pm - 5:25pm 424 Pupin Laboratories	Kerstin Perez	0.00	23/30

PHYS UN2001 SPECIAL RELATIVITY. 3.00 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: a working knowledge of high school algebra, trigonometry, and physics. Some familiarity with calculus is useful but not essential. This course is a comprehensive, one-semester introduction to the essential ideas and mathematical structures underlying Einstein's Special Theory of Relativity. Among the topics covered will be: the relativity of simultaneity, time dilation, Lorentz contraction, velocity combination laws, time dilation over large distances, the Lorentz transformation, spacetime diagrams, the basic (seeming) paradoxes of special relativity, relativistic equations of motion and $E = mc^2$.

PHYS UN2601 PHYSICS III: CLASS/QUANTUM WAVE. 3.50 points.Prerequisites: PHYS UN1402 or PHYS UN1602 *PHYS W1402* or *W1602*.

Prerequisites: PHYS UN1402 or PHYS UN1602 Corequisite: MATH UN1202 or equivalent. Classical waves and the wave equation, geometrical optics, interference and diffraction, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, reflection and transmission coefficients, the harmonic oscillator. The course is preparatory for advanced work in physics and related fields

Fall 2026: PHYS UN2601

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 2601	001/12363	T Th 2:40pm - 3:55pm 329 Pupin Laboratories	James McIver	3.50	98/130

PHYS UN2603 Physics III: Class/Quantum Wave - Rec. 0.00 points.

Fall 2026: PHYS UN2603

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 2603	001/12579	M 5:10pm - 6:00pm C01 Knox Hall	James McIver	0.00	21/25
PHYS 2603	002/12580	T 5:10pm - 6:00pm 329 Uris Hall	James McIver	0.00	11/25
PHYS 2603	003/12581	T 6:10pm - 7:00pm 424 Pupin Laboratories	James McIver	0.00	12/25
PHYS 2603	004/12582	W 5:10pm - 6:00pm 703 Hamilton Hall	James McIver	0.00	21/25
PHYS 2603	005/12583	W 6:10pm - 7:00pm 222 Pupin Laboratories	James McIver	0.00	8/25

PHYS UN2699 Experiments in Classical and Modern Physics. 3 points.

CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (PHYS UN1601 or PHYS UN1401) and (PHYS UN1602 or PHYS UN1402) and PHYS UN2601 *PHYS W1601* (or *W1401*), *W1602* (or *W1402*), and *W2601*.

Laboratory work associated with the three prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic physics, and nuclear physics.

PHYS UN2801 ACCELERATED PHYSICS I. 4.50 points.

Prerequisites: Advanced Placement in physics and mathematics, or the equivalent, and the instructor's permission. (A special placement meeting is held during Orientation.)

Prerequisites: Advanced Placement in physics and mathematics, or the equivalent, and the instructor's permission. (A special placement meeting is held during Orientation.) This accelerated two-semester sequence covers the subject matter of PHYS UN1601, PHYS UN1602 and PHYS UN2601, and is intended for those students who have an exceptionally strong background in both physics and mathematics. The course is preparatory for advanced work in physics and related fields. There is no accompanying laboratory; however, students are encouraged to take the intermediate laboratory, PHYS UN3081, in the following year

Fall 2026: PHYS UN2801

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 2801	001/12364	T Th 10:10am - 12:00pm 329 Pupin Laboratories	Brian Cole	4.50	11/70

PHYS UN2802 ACCELERATED PHYSICS II. 4.50 points.Prerequisites: PHYS UN2801 *PHYS W2801*.

Prerequisites: PHYS UN2801 This accelerated two-semester sequence covers the subject matter of PHYS UN1601, PHYS UN1602 and PHYS UN2601, and is intended for those students who have an exceptionally strong background in both physics and mathematics. The course is preparatory for advanced work in physics and related fields. There is no accompanying laboratory; however, students are encouraged to take the intermediate laboratory, PHYS UN3081, in the following year

Spring 2026: PHYS UN2802

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 2802	001/13929	T Th 10:10am - 12:00pm 329 Pupin Laboratories	Yury Levin	4.50	36/50

PHYS UN2803 ACCELERATED PHYSICS I-REC. 0.00 points.**PHYS UN2804 ACCELERATED PHYSICS II-REC. 0.00 points.**

Required discussion section for PHYS UN2802 Accelerated Physics II

PHYS UN3002 From Quarks To the Cosmos: Applications of Modern Physics. 3.5 points.

This course reinforces basic ideas of modern physics through applications to nuclear physics, high energy physics, astrophysics and cosmology. The ongoing Columbia research programs in these fields are used as practical examples. The course is preparatory for advanced work in physics and related fields.

PHYS UN3003 MECHANICS. 3.00 points.

Prerequisites: general physics, and differential and integral calculus.

Prerequisites: general physics, and differential and integral calculus.

Newtonian mechanics, oscillations and resonance, conservative forces and potential energy, central forces, non-inertial frames of reference, rigid body motion, an introduction to Lagrange's formulation of mechanics, coupled oscillators, and normal modes

Spring 2026: PHYS UN3003

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3003	001/13930	M W 10:10am - 11:25am 329 Pupin Laboratories	John Parsons	3.00	68/75

PHYS UN3007 ELECTRICITY-MAGNETISM. 3.00 points.

Prerequisites: general physics, and differential and integral calculus.

Prerequisites: general physics, and differential and integral calculus.

Electrostatics and magnetostatics, Laplace's equation and boundary-value problems, multipole expansions, dielectric and magnetic materials, Faraday's law, AC circuits, Maxwell's equations, Lorentz covariance, and special relativity

Fall 2026: PHYS UN3007

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3007	001/12365	T Th 1:10pm - 2:25pm 329 Pupin Laboratories	Alberto Nicolis	3.00	67/100

PHYS UN3008 ELECTROMAGNETIC WAVES # OPTICS. 3.00 points.

Prerequisites: PHYS UN3008 *PHYS W3007*.

Prerequisites: PHYS UN3008 Maxwells equations and electromagnetic potentials, the wave equation, propagation of plane waves, reflection and refraction, geometrical optics, transmission lines, wave guides, resonant cavities, radiation, interference of waves, and diffraction

Spring 2026: PHYS UN3008

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3008	001/13931	T Th 2:40pm - 3:55pm 329 Pupin Laboratories	James McIver	3.00	72/75

PHYS UN3072 SEM IN CURRENT RES. PROBLEMS. 2.00 points.

A detailed study of a selected field of active research in physics. The motivation, techniques, and results obtained to the present, as well as the difficulties and unsolved problems. For Physics majors only. Priority given to seniors; juniors by permission of the instructor

Fall 2026: PHYS UN3072

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3072	001/12366	M 5:30pm - 7:00pm 414 Pupin Laboratories	Kerstin Perez	2.00	30/30

PHYS UN3081 INTERMEDIATE LABORATORY WORK. 2.00 points.

May be repeated for credit by performing different experiments. The laboratory has available fifteen individual experiments, of which two are required per 2 points.

Prerequisites: phys UN2601 or phys un2802 *PHYS W2601* or *PHYS W2802*. Primarily for junior and senior physics majors; other majors must obtain the instructor's permission.

Prerequisites: phys UN2601 or phys un2802 Primarily for junior and senior physics majors; other majors must obtain the instructors permission. Each experiment is chosen by the student in consultation with the instructor. Each section meets one afternoon per week, with registration in each section limited by the laboratory capacity. Experiments (classical and modern) cover topics in electricity, magnetism, optics, atomic physics, and nuclear physics

Spring 2026: PHYS UN3081

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3081	002/13933	Th 1:10pm - 5:00pm 6th Flr Pupin Laboratories	Tanya Zelevinsky	2.00	8/12
PHYS 3081	003/13932	F 1:10pm - 5:00pm 6th Flr Pupin Laboratories	Morgan May	2.00	15/16

Fall 2026: PHYS UN3081

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3081	001/12368	W 1:10pm - 5:00pm 6th Flr Pupin Laboratories	Elena Aprile	2.00	13/14
PHYS 3081	002/12367	Th 1:10pm - 5:00pm 6th Flr Pupin Laboratories	Elena Aprile	2.00	4/14
PHYS 3081	003/12369	F 1:10pm - 5:00pm 6th Flr Pupin Laboratories	Morgan May	2.00	6/15

PHYS UN3083 ELECTRONICS LABORATORY. 3.00 points.

Enrollment limited to the capacity of the laboratory.

Prerequisites: PHYS UN3003 or PHYS UN3007 *PHYS W3003* or *W3007*. May be taken before or concurrently with this course.

Prerequisites: PHYS UN3003 or PHYS UN3007 May be taken before or concurrently with this course. A sequence of experiments in solid-state electronics, with introductory lectures

Fall 2026: PHYS UN3083

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3083	001/12370	M W 1:10pm - 4:00pm 5th Flr Pupin Laboratories	John Parsons	3.00	15/14

PHYS UN3084 Quantum Simulation and Computing Lab. 3.00 points.

The “Quantum Simulation and Computing Lab” will give students hands-on experience in quantum optics, quantum simulation and quantum computing. The course combines lectures, tutorials, and two lab sections. In one lab section, students will do experiments with entangled photons. In the second lab section, students will program quantum computers and run algorithms on them using the IBM Qiskit platform. The course starts with a recap of linear algebra and quantum mechanics, followed by an introduction to quantum optics and quantum information. Two-level systems, Bloch sphere, quantum gates, and elementary quantum algorithms will be discussed. Quantum teleportation and quantum key distribution will be introduced as applications of entanglement. The lecture content will be directly applied in experiments with entangled photons. In the following, state-of-the-art quantum algorithms will be discussed, related to cutting-edge research results in quantum computing. This includes quantum Fourier transform, quantum simulation of the Schrodinger equation, and the variational quantum eigensolver (VQE) algorithm. During the course students will do one experimental project with entangled photons and one quantum programming project. Students will be guided to implement a quantum algorithm of their choice and run it on a quantum computer (IBM, IonQ, QuEra)

Spring 2026: PHYS UN3084

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3084	001/13935	W F 1:10pm - 2:25pm 415 Schapiro Cepser	Zhenjie Yan	3.00	13/20

PHYS UN3500 SUPERVISED READINGS IN PHYSICS. 3.00 points.

Prerequisites: the written permission of the faculty member who agrees to act as supervisor, and the director of undergraduate studies permission. Readings in a selected field of physics under the supervision of a faculty member. Written reports and periodic conferences with the instructor

Spring 2026: PHYS UN3500

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3500	001/17124		Jeremy Dodd	3.00	0/5

Fall 2026: PHYS UN3500

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3500	001/12371		Jeremy Dodd	3.00	3/5

PHYS UN3900 SUPERVISED INDIVIDUAL RESEARCH. 3.00-5.00 points.

Prerequisites: Permission of the departmental representative required. For specially selected students, the opportunity to do a research problem in contemporary physics under the supervision of a faculty member.

Each year several juniors are chosen in the spring to carry out such a project beginning in the autumn term. A detailed report on the research is presented by the student when the project is complete

Spring 2026: PHYS UN3900

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3900	001/13936		Jeremy Dodd	3.00-5.00	22/20

Summer 2026: PHYS UN3900

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3900	001/12824		Jeremy Dodd	3.00-5.00	1/1

Fall 2026: PHYS UN3900

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 3900	001/12372		Jeremy Dodd	3.00-5.00	7/20

PHYS GU4003 ADVANCED MECHANICS. 3.00 points.

Prerequisites: differential and integral calculus, differential equations, and *PHYS W3003* or the equivalent.

Prerequisites: differential and integral calculus, differential equations, and PHYS UN3003 or the equivalent. Lagranges formulation of mechanics, calculus of variations and the Action Principle, Hamiltons formulation of mechanics, rigid body motion, Euler angles, continuum mechanics, introduction to chaotic dynamics

Spring 2026: PHYS GU4003

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4003	001/13937	T Th 1:10pm - 2:25pm 141 Uris Hall	Alberto Nicolis	3.00	37/50

PHYS GU4011 PARTICLE ASTROPHYS # COSMOLOGY. 3.00 points.

Prerequisites: (PHYS UN1403 or PHYS UN2601 or PHYS UN2802) and (MATH UN1202 or MATH UN1208)

Prerequisites: (PHYS UN1403 or PHYS UN2601 or PHYS UN2802) and (MATH UN1202 or MATH UN1208) students are recommended but not required to have taken PHYS UN3003 and PHYS UN3007. An introduction to the basics of particle astrophysics and cosmology. Particle physics - introduction to the Standard Model and supersymmetry/higher dimension theories; Cosmology – Friedmann-Robertson-Walker line element and equation for expansion of universe; time evolution of energy/matter density from the Big Bang; inflationary cosmology; microwave background theory and observation; structure formation; dark energy; observational tests of geometry of universe and expansion; observational evidence for dark matter; motivation for existence of dark matter from particle physics; experimental searches of dark matter; evaporating and primordial black holes; ultra-high energy phenomena (gamma-rays and cosmic-rays)

PHYS GU4012 STRING THEORY. 3.00 points.

Prerequisites: PHYS UN3003 and PHYS UN3008 and PHYS GU4021 *PHYS W3003, PHYS W3008, PHYS W4021. PHYS W4023* would be helpful but is not required. Students should have some familiarity with tools for graphical presentation and numeric problem solving such as Mathematica and/or MatLab.

This course is intended as an introduction to string theory for undergraduates. No advanced graduate-level preparation is assumed, and the material will be covered at (no higher than) the advanced undergraduate level. Advanced topics such as supersymmetry, T-duality, and covariant quantization will not be covered. The focus will be on the dynamics of classical and quantum mechanical strings, with an emphasis on integrating undergraduate material in classical mechanics, relativity, electrodynamics and quantum mechanics.

PHYS GU4018 SOLID STATE PHYSICS. 3.00 points.

Prerequisites: PHYS GU4021 and PHYS GU4023 *PHYS W4021* and *W4023*, or the equivalent.

Prerequisites: PHYS GU4021 and PHYS GU4023 or the equivalent.

Introduction to solid-state physics: crystal structures, properties of periodic lattices, electrons in metals, band structure, transport properties, semiconductors, magnetism, and superconductivity

Spring 2026: PHYS GU4018

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4018	001/13938	M W 10:10am - 11:25am 307 Pupin Laboratories	Cory Dean	3.00	19/30

PHYS GU4019 MATHEMATICAL METHODS OF PHYSICS. 3.00 points.

Prerequisites: PHYS UN3003 and PHYS UN3007 and differential and integral calculus; linear algebra; *PHYS W3003* and *PHYS W3007*; or the instructor's permission.

Prerequisites: PHYS UN3003 and PHYS UN3007 and differential and integral calculus; linear algebra; or the instructor's permission. This course will present a wide variety of mathematical ideas and techniques used in the study of physical systems. Topics will include: ordinary and partial differential equations; generalized functions; integral transforms; Green's functions; nonlinear equations, chaos, and solitons; Hilbert space and linear operators; Feynman path integrals; Riemannian manifolds; tensor analysis; probability and statistics. There will also be a discussion of applications to classical mechanics, fluid dynamics, electromagnetism, plasma physics, quantum mechanics, and general relativity

Fall 2026: PHYS GU4019

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4019	001/12373	T Th 2:40pm - 3:55pm 420 Pupin Laboratories	Sebastian Mizera	3.00	40/40

PHYS GU4021 QUANTUM MECHANICS I. 3.00 points.

Prerequisites: PHYS UN3003 and PHYS UN3007 *W3003*, *W3007*, *BC3006*.

Prerequisites: PHYS UN3003 and PHYS UN3007 Formulation of quantum mechanics in terms of state vectors and linear operators. Three dimensional spherically symmetric potentials. The theory of angular momentum and spin. Identical particles and the exclusion principle. Methods of approximation. Multi-electron atoms

Fall 2026: PHYS GU4021

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4021	001/12374	T Th 8:40am - 9:55am 329 Pupin Laboratories	Emlyn Hughes	3.00	64/100

PHYS GU4022 QUANTUM MECHANICS II. 3.00 points.

Prerequisites: PHYS GU4021. Formulation of quantum mechanics in terms of state vectors and linear operators, three-dimensional spherically symmetric potentials, the theory of angular momentum and spin, time-independent and time-dependent perturbation theory, scattering theory, and identical particles. Selected phenomena from atomic physics, nuclear physics, and elementary particle physics are described and then interpreted using quantum mechanical models

Spring 2026: PHYS GU4022

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4022	001/13939	M W 11:40am - 12:55pm 329 Pupin Laboratories	Alfred Mueller, Giuseppina Cambareri	3.00	72/75

PHYS GU4023 THERMAL & STATISTICAL PHYSICS. 3.00 points.

Prerequisites: PHYS GU4021 *PHYS W4021* or the equivalent.

Prerequisites: PHYS GU4021 or the equivalent. Thermodynamics, kinetic theory, and methods of statistical mechanics; energy and entropy; Boltzmann, Fermi, and Bose distributions; ideal and real gases; blackbody radiation; chemical equilibrium; phase transitions; ferromagnetism

Fall 2026: PHYS GU4023

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4023	001/12375	T Th 10:10am - 11:25am 330 Uris Hall	Tanya Zelevinsky	3.00	54/60

PHYS GU4024 Applied Quantum Mechanics. 3 points.

Prerequisites: (PHYS GU4021 and PHYS GU4022)

In this course, we will learn how the concepts of quantum mechanics are applied to real physical systems, and how they enable novel applications in quantum optics and quantum information. We will start with microscopic, elementary quantum systems – electrons, atoms, and ions – and understand how light interacts with atoms. Equipped with these foundations, we will discuss fundamental quantum applications, such as atomic clocks, laser cooling and ultracold quantum gases – a synthetic form of matter, cooled down to just a sliver above absolute zero temperature. This leads us to manybody quantum systems. We will introduce the quantum physics of insulating and metallic behavior, superfluidity and quantum magnetism – and demonstrate how the corresponding concepts apply both to real condensed matter systems and ultracold quantum gases. The course will conclude with a discussion of the basics of quantum information science – bringing us to the forefront of today's quantum applications.

Fall 2026: PHYS GU4024

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4024	001/12376	T Th 2:40pm - 3:55pm 516 Hamilton Hall	Sebastian Will	3	22/30

PHYS GU4040 INTRO TO GENERAL RELATIVITY. 3.00 points.

Prerequisites: PHYS UN3003 and PHYS UN3007 *PHYS W3003*, *PHYS W3007* or the equivalent.

Prerequisites: PHYS UN3003 and PHYS UN3007 or the equivalent. Tensor algebra, tensor analysis, introduction to Riemann geometry. Motion of particles, fluid, and fields in curved spacetime. Einstein equation. Schwarzschild solution; test-particle orbits and light bending. Introduction to black holes, gravitational waves, and cosmological models

Spring 2026: PHYS GU4040

Course Number	Section/Call Number	Times/Location	Instructor	Points	Enrollment
PHYS 4040	001/13940	T Th 4:10pm - 5:25pm 414 Pupin Laboratories	James Hill	3.00	19/30

PHYS GU4050 Introduction to Particle Physics. 3.00 points.

Prerequisites: PHYS UN2601 or PHYS UN2802

Prerequisites: PHYS UN2601 or PHYS UN2802 or the equivalent. This course covers the Standard Model of Particle Physics, including its conception, successes, and limitations, with the goal of introducing upper-level physics majors to the foundations and current status of particle physics as a field of research. Specific topics to be covered include: historical introduction and review of the Standard Model; particle interactions and particle dynamics; relativistic kinematics; Feynman calculus, quantum electrodynamics, quantum chromodynamics, and weak interactions; electroweak unification and the Higgs mechanism; neutrino oscillations; and beyond-standard model physics and evidence. Along the way, students will research special topics and familiarize themselves with particle physics research

PHYS GU4051 ADVANCED LABORATORY WORK. 2.00 points.

Prerequisites: the instructor's permission. The laboratory has 13 available individual experiments, of which two are required per 2 points. Each experiment requires two (four-hour) laboratory sessions. Registration is limited by the laboratory capacity. May be repeated for credit with different experiment selection. Experiments (classical and modern) cover topics in electricity, magnetism, optics, atomic physics, and nuclear physics

PHYS GU4386 GEOMETRICAL CONCEPTS IN PHYSICS. 3.00 points.

PHYS GU4998 SUPERVISED READINGS. 3.00 points.