

Department of Physics

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Department of Physics

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Description of Department/Programs

The Department of Physics offers the bachelor of science and bachelor of arts degrees. These degrees can be obtained using a traditional program of study suggested for students interested in advancing to graduate school or seeking employment upon completion of their undergraduate degree.

The department offers a master of science degree in physics with thesis and non-thesis options.

The Department of Physics is eligible for full participation in UMKC's Interdisciplinary Ph.D. Program. Qualified students can select physics as a discipline when applying for admission or preparing their doctoral program of study. (See the School of Graduate Studies section of this catalog for details about the Interdisciplinary Ph.D. program.)

Many physics courses are offered in the late afternoon or evening to accommodate part-time students.

Graduate Degree Programs

The department offers an M.S. in physics with thesis and non-thesis options. The Department of Physics is an academic discipline eligible for full participation in UMKC's Interdisciplinary Ph.D. program. Qualified students can select physics as their coordinating unit or co-discipline when applying for admission or preparing their Ph.D. plan of study. A separate brochure, available from the department, describes the graduate programs in more detail.

Graduate Admissions

To be admitted to the graduate program, a student must meet the general admission requirements for the School of Graduate Studies and have undergraduate preparation in physics. An undergraduate major in physics is not required, and deficiencies in completed coursework may be overcome by taking additional undergraduate-level courses for graduate credit. Applicants are encouraged to take both the Graduate Record Examination (GRE) aptitude test and physics test. International students must take the Test of English as a Foreign Language (TOEFL). Admission will be based on academic record and other information such as letters of reference, GRE score and personal interview. See the School of Graduate Studies section in this catalog for requirements for admission to the Interdisciplinary Ph.D. program.

Career Implications of the Master's Degree

The master's degree programs in physics are intended to serve the following groups:

- Those who wish to obtain a master of science degree but do not expect to go further in graduate work.
- Those who intend to work toward a Ph.D. in physics after obtaining the M.S. degree.
- Those who wish to take graduate courses in physics as part of a program in some other discipline or for educational or professional reasons.
- Those who wish to obtain an Interdisciplinary Ph.D. degree from UMKC in two or more academic disciplines, one of which is physics.

The career implications for students with an M.S. degree in physics and seeking employment are similar to those with B.S. degrees, but they will have a more advanced standing and experience in science department activities.

A student who is entering the graduate program with the objective of earning a master of science degree will select or be assigned an adviser. This assignment should be made during the first semester, if possible. Together, the student and the adviser will work out the complete program of study for the master of science degree. Students entering UMKC's Interdisciplinary Ph.D. program, and choosing physics as one of their academic disciplines, must follow the academic regulations of the School of Graduate Studies as set forth in the School of Graduate Studies section in this catalog. All graduate students in physics who have completed more than 6 graduate credit hours must take a departmental examination in the fall.

Scholarships, Fellowships and Assistantships

Financial support is available through fellowships, teaching assistantships, research assistantships or hourly student wages. Students wishing to be considered for an assistantship must so specify in their letters and application forms.

Student Learning Outcomes

Master of Science in Physics

Students graduating with an M.S. in physics will:

- Have an advanced knowledge of the basic areas of physics.
- Be able to integrate their knowledge with critical thinking skills in order to become problem solvers.
- Be able to clearly articulate scientific information, both orally and in writing.
- Be able to effectively use the scientific literature.

Students graduating with an M.S. in physics will be prepared for entry into professional schools, graduate programs or the job market.

Master of Science

Description of the Program

The master of science degree may be earned by fulfilling the requirements for the master of science with thesis or the master of science without thesis.

A full-time graduate student seeking a master of science degree will normally be expected to take the thesis option. The without-thesis option is mainly designed for part-time students who already have career employment.

The following five graduate-level courses are defined as core courses for the M.S. All graduate students should take these courses as soon as possible after admission to graduate study.

Physics 5500: Mathematical Physics I
 Physics 5510: Theoretical Mechanics I
 Physics 5520: Electromagnetic Theory I
 Physics 5530: Quantum Mechanics I
 Physics 5540: Statistical Physics I

Requirements of the Major

In addition to requirements set by the School of Graduate Studies, the following requirements must be satisfied for graduation:

Requirements for the M.S. Degree With Thesis

- 30 graduate credit hours with the following constraints:
 - At least 12 credit hours of M.S. core courses.
 - A maximum of six credit hours for the thesis (Physics 5599).
 - No more than nine credit hours of 400-level courses.
- A comprehensive written examination covering all basic areas of undergraduate and graduate physics.
- A satisfactory thesis.
- A final oral examination.

Requirements for the M.S. Degree Without Thesis

- 36 graduate credit hours with the following constraints:
 - 15 credit hours of core M.S. courses.
 - No more than six credit hours of 400-level physics courses and no more than six credit hours of non-physics courses without the approval of the supervisory committee.
- A comprehensive final written examination covering all areas of basic undergraduate and graduate physics.

All graduate students must maintain a grade-point average of 3.0 ($A = 4.0$). A student who chooses the thesis option must maintain satisfactory progress on a research project. There are no language requirements for the M.S. degree.

Graduate students should consult with the principal graduate adviser prior to enrollment.

Interdisciplinary Ph.D. Program Regulations

Regulations

The Department of Physics is a full participant in the Interdisciplinary Ph.D. Program. The doctoral studies committee of the department has the primary responsibility for administering the program within the department. The committee consists of all physics doctoral faculty members with an elected committee chairperson.

See the School of Graduate Studies section in this catalog and the departmental graduate brochure for general and discipline-specific regulations for Interdisciplinary Ph.D. study with physics as a coordinating unit discipline or co-discipline.

Physics Courses

5500 Methods Of Mathematical Physics I (3). Intended to provide the student with the advanced mathematical techniques needed for beginning graduate studies in the physical sciences. Content includes real variables, infinite series, complex analysis, linear algebra and partial differential equations. Offered: Fall.

5501 Methods Of Mathematical Physics II (3). A continuation of Physics 500 which includes Sturm-Liouville operators, special functions, Fourier transforms, distributions and Green functions, Laplace transforms, linear groups and tensor analysis. Offered: Winter.

5505 Survey Of Recent Development In Physics (3). Specifically designed to help high school and junior college science teachers keep pace with current developments in various subdivisions of physics and their impact on society and technology. (Not applicable for graduate degree in Physics). Prerequisite: Baccalaureate degree and one year science teaching experience. Offered: On Demand.

5510 Theoretical Mechanics I (3). A review of undergraduate mechanics precedes the study of generalized classical mechanics in this course. Topics include variational principles, Lagrangian and Hamilton methods, conservation laws and Hamilton-Jacobi theory. Offered: Fall.

5511 Theoretical Mechanics II (3). A continuation of Physics 510, this course covers topics such as normal coordinates, small oscillations, continuum mechanics and special/general relativity. Offered: On Demand.

5520 Electromagnetic Theory And Applications I (3). Electrostatics, magnetostatics and various approaches in solving boundary value problems of electromagnetism, Green's functions, conformal transformations and polynomial expansions, Maxwell's equations and waves. Offered: Winter

5521 Electromagnetic Theory And Applications II (3). Waveguides, fiberoptics, radiation systems and antenna for wireless communications, scattering and diffraction of electromagnetic waves, multipole fields, special relativity and relativistic particle dynamics and radiation. Offered: Fall

5530 Quantum Mechanics I (3). Review of elementary methods, formal preliminaries, axioms, commuting operators, angular momentum, static perturbation theory, Wigner-Eckart theorem. Offered: Fall.

5531 Quantum Mechanics II (3). Time dependent perturbation theory, scattering, applications to atoms, molecules and nuclei, reactions, relativistic methods. Offered: Winter.

5535 Optical Properties Of Matter (3). Maxwell's equations and the dielectric function, absorption and dispersion, free-electron metals, interband transitions, dispersion relations and sum rules, self-consistent field approximation, current-current correlations and the fluctuation-dissipation theorem, plasmons and characteristic energy loss. Prerequisites: Physics 450, 460, 461, 471, 472, 500. Offered: Fall Even Years.

5540 Statistical Physics I (3). Statistical mechanics as a basis for thermodynamics; classical distribution functions; quantum statistical mechanics, kinetic theory, transport phenomena; application to systems of interacting particles. Prerequisites: Physics 410, 471, 472. Offered: Fall Even Years.

5541 Statistical Physics II (3). Special topics in advanced statistical physics including: second quantization, modern many body theory, interacting Fermi and Bose systems, superfluidity and superconductivity, renormalization group and computer simulation techniques. Prerequisite: Physics 540. Offered: On Demand.

5550 Atomic And Molecular Structure (3). Experimental results and theoretical models by quantum mechanics. Special emphasis on the interaction between radiation and matter. Offered: On Demand.

5560 Nuclear Physics (3). Fundamental properties of the atomic nucleus discussed in terms of experimental results and theoretical models. Quantum and statistical mechanics are used where appropriate. Offered: On Demand.

5570 Quantum Theory Of Solids I (3). Lattice dynamics and thermal conductivity. Neutron scattering. Symmetry principles in crystals and consequences. Point group, space group and irreducible representations. Energy band theory and methods of band calculation. Elementary Theory of Magnetism. Spin wave theory. Offered: Winter Odd Years.

5571 Quantum Theory Of Solids II (3). Topics will include crystal imperfections, impurities and defects, optical properties of metals and semiconductors, electron-lattice interaction and transport theory, superconductivity and theory of disordered systems. Offered: On Demand.

5580 Physics Seminar (1). Contemporary publications and research.

5590 Topics In Physics (1-3). Contemporary publications and research.

5590A Topics In Physics (1-3). Contemporary publications and research.

5595L Computer Interfacing Laboratory (3). An introduction to computer interfacing through the use of serial and parallel ports and digital-to-analog and analog-to-digital converters. The course also introduces digital filtering techniques, data analysis techniques, and graphical presentation of data. The programming techniques are taught using high level programming languages currently used in research and development labs. Offered: Fall Even Years.

5599 Research And Thesis (1-9). Research for thesis in partial fulfillment of the master's degree in physics.

5630 Advanced Quantum Theory (3). Scattering theory and reactions, relativistic quantum mechanics and quantum field theory, many-body problems and Green functions. Prerequisites: Physics 530-531 or consent of instructor. Offered: Alternate Years Fall.

5680 Research Seminar (1-2). Seminars on current research topics of research programs in the department and those of external distinguished scientists. (Must be taken by Physics Ph.D. students). Offered: Fall and Spring.

5690 Special Research Topics (1-3). A lecture course presenting advanced research-level topics. Prerequisite: Ph.D. candidacy or consent of instructor. Offered: On Demand. This course is intended to allow faculty and visiting scholars to offer special courses in selected research areas.

5699 Research And Dissertation (1-9). Research for dissertation in partial fulfillment of the Ph.D. degree requirements in physics.

5899 Required Graduate Enrollment (1).