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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<td>PHYS401</td>
<td>Quantum Physics I (4 Credits)</td>
<td>4</td>
<td>Previous coursework in quantum mechanics.</td>
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<td>PHYS402</td>
<td>Quantum Physics II (4 Credits)</td>
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<td>PHYS404</td>
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<td>3</td>
<td>Previous coursework in thermodynamics.</td>
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<td>PHYS405</td>
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<td>PHYS407</td>
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<td>PHYS410</td>
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<tr>
<td>PHYS411</td>
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<tr>
<td>PHYS420</td>
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<td>PHYS428</td>
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<td>PHYS429</td>
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<tr>
<td>PHYS431</td>
<td>Properties of Matter (3 Credits)</td>
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<td>PHYS441</td>
<td>Topics in Nuclear and Particle Physics (3 Credits)</td>
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<td>PHYS460</td>
<td>Electrodynamics (4 Credits)</td>
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<td>PHYS485</td>
<td>Electronic Circuits (4 Credits)</td>
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<td>Previous coursework in electronic circuits.</td>
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<tr>
<td>PHYS499</td>
<td>Special Problems in Physics (1-16 Credits)</td>
<td>1-16</td>
<td>Previous coursework in special problems in physics.</td>
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<tr>
<td>PHYS501</td>
<td>Theoretical Dynamics (3 Credits)</td>
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<td>Previous coursework in theoretical dynamics.</td>
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<tr>
<td>PHYS503</td>
<td>Methods of Statistical Physics (3 Credits)</td>
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<td>Previous coursework in methods of statistical physics.</td>
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<td>PHYS504</td>
<td>Methods of Mathematical Physics (3 Credits)</td>
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<td>Previous coursework in methods of mathematical physics.</td>
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<tr>
<td>PHYS506</td>
<td>Electrodynamics (4 Credits)</td>
<td>4</td>
<td>Previous coursework in electrodynamics.</td>
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PHYS615 Nonlinear Dynamics of Extended Systems (3 Credits)
Theory and applications of nonlinear dynamics of extended systems including nonlinear waves, pattern formation, turbulence, self-organized criticality and networks. Additional topics to be selected by instructor from areas of current research.
Prerequisite: PHYS601.

PHYS621 Graduate Laboratory (3 Credits)
Design and performance of advanced experiments in modern and classical physics.
Prerequisite: PHYS405; or students who have taken courses with comparable content may contact the department.

PHYS622 Introduction to Quantum Mechanics I (4 Credits)
First and second semesters. A study of the Schrödinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc. Applications to solid state, atomic, and nuclear physics.
Prerequisite: Must have an outstanding undergraduate background in physics.

PHYS623 Introduction to Quantum Mechanics II (3 Credits)
First and second semesters. A study of the Schrödinger equation, matrix formulations of quantum mechanics, approximation methods, scattering theory, etc., and applications to solid state, atomic, and nuclear physics. Continuation of PHYS 622.
Prerequisite: Must have an outstanding undergraduate background in physics.

PHYS624 Advanced Quantum Mechanics (3 Credits)
Relativistic wave equations, second quantization in many body problems and relativistic wave equations, Feynman-Dyson perturbation theory, applications to many body problems, application to quantum electrodynamics, elements of renormalization.
Prerequisite: PHYS623.

PHYS625 Non-relativistic Quantum Mechanics (3 Credits)
Non-relativistic second quantization, single particle Green's function, perturbation theory, linked cluster expansion, Feynman and Goldstone diagrams; applications to imperfect Fermi gases; superconductivity.
Prerequisite: PHYS623.

PHYS626 Introduction to Relativity, Gravitation and Cosmology (3 Credits)
Review of special relativity, followed by a study of the equivalence principle, curved spacetimes, and Einstein's equations. Selected applications to the solar system, stellar structure, black holes, gravitational waves, and cosmology.
Prerequisite: PHYS606 and PHYS601.

PHYS685 Research Electronics (4 Credits)
An integrated lecture and laboratory course in electronics with equal emphasis on experimental methods and results and analysis using device models and up-to-date mathematical and numerical tools. Experiments and analysis of circuits with passive and single active devices form the background for the study of operational amplifiers, digital integrated circuits and systems, and microcomputers. The general topics of impedance matching, frequency response, feedback, interfacing and the extraction of signal from noise are stressed.
Prerequisite: PHYS374 or PHYS405; or students who have taken courses with comparable content may contact the department.
Restriction: Must not have completed PHYS485.
Credit Only Granted for: PHYS485 or PHYS685.

PHYS704 Statistical Mechanics (3 Credits)
A study of the determination of behavior of matter from microscopic models. Microcanonical, canonical, and grand canonical models. Applications of solid state physics and the study of gases.
Prerequisite: PHYS411.

PHYS708 Seminar in Teaching College Physics (1 Credit)
PHYS709 Seminar in General Physics (1 Credit)
PHYS711 Symmetry Problems in Physics (3 Credits)
A study of general methods of classification of physical systems by their symmetries and invariance properties, especially in quantum field theory applications.
Prerequisite: PHYS623.

PHYS715 Chaotic Dynamics (3 Credits)
Theory and applications of chaos in dynamical systems including such topics as strange attractors, Lyapunov exponents, quasiperiodicity, period doubling, intermittency, crises, fractal basin boundaries, chaotic scattering, KAM tori, and quantum chaos.
Prerequisite: PHYS601.

PHYS718 Seminar in General Physics (1 Credit)
PHYS719 Seminar in General Physics (1 Credit)
PHYS721 Atomic and Optical Physics I (Survey) (3 Credits)
A survey of topics involving the physics of atoms and their interaction with radiation, including atoms in external fields, lasers, atomic spectroscopy and atomic structure.
Prerequisite: PHYS623.

PHYS728 Seminar in Atomic and Molecular Physics (1 Credit)
PHYS731 Solid State Physics: Survey (3 Credits)
A variety of topics such as crystal structure, mechanical, thermal, electrical, and magnetic properties of solids, band structure, the Fermi surface, and superconductivity will be treated. Although the emphasis will be on the phenomena, the methods of quantum mechanics are freely employed in this description.

PHYS732 Introduction to Solid State Physics II (3 Credits)
Second semester of survey course in condensed matter physics including topics in semiconductors, surface physics, magnetism and superconductivity.
Prerequisite: PHYS731.

PHYS733 Seminar in Experimental Solid State Physics (1 Credit)
PHYS739 Seminar in Theoretical Solid State Physics (1 Credit)
PHYS741 Nuclear Physics: Survey (3 Credits)
An introductory survey of nuclear physics, including the following topics: properties of the two-nucleon force and the most popular phenomenological potentials; properties of nuclei including radii, shapes and charge distributions; introduction to nuclear structure models, including collective, independent particle, and shell model; basic features of radioactivity including weak interactions and alpha decay; introduction to nuclear reactions, including phenomenological optical potentials and distorted wave approximations.
Prerequisite: PHYS623 and PHYS622.

PHYS748 Seminar in Experimental Nuclear Physics (1 Credit)
PHYS749 Seminar in Theoretical Nuclear Physics (1 Credit)
PHYS751 Elementary Particle Physics I: Survey (3 Credits)
Nuclear forces are studied by examining interactions at high energies. Meson physics, scattering processes, and detailed analysis of high energy experiments.
Corequisite: PHYS624.
PHYS752 Elementary Particle Physics II: Theory (3 Credits)
Survey of elementary particles and their properties, quantum field theory, meson theory, weak interactions, possible extensions of elementary particle theory.
Prerequisite: PHYS751 and PHYS624.

PHYS758 Seminar in Elementary Particles and Quantum Field Theory (1 Credit)

PHYS759 Seminar in Elementary Particles and Quantum Field Theory (1 Credit)

PHYS761 Plasma Physics I: Survey (3 Credits)
A detailed study of plasma physics. The first semester treats particle orbit theory, magnetohydrodynamics, plasma waves, and transport phenomena.
Prerequisite: PHYS606 and PHYS604.

PHYS762 Plasma Physics II (3 Credits)
Continuation of PHYS 761. Vlasov theory, including waves, stability, and weak turbulence, kinetic equation theories of correlations and radiative processes.
Prerequisite: PHYS761.

PHYS769 Seminar in Plasma Physics (1 Credit)

PHYS778 Seminar in Space and Cosmic Ray Physics (1 Credit)

PHYS779 Seminar in General Relativity (1 Credit)

PHYS798 Special Problems in Advanced Physics (1-3 Credits)
Projects or special study in advanced physics.

PHYS799 Master's Thesis Research (1-6 Credits)

PHYS808 Special Topics in General Physics (1-4 Credits)
Credit according to work done.

PHYS809 Special Topics in General Physics (1-4 Credits)
Credit according to work done.

PHYS818 Special Topics in General Physics (1-4 Credits)
Credit according to work done.

PHYS828 Special Topics in Atomic and Molecular Physics (1-4 Credits)
Credit according to work done.

PHYS829 Special Topics in Quantum Mechanics and Quantum Electronics (1-4 Credits)
Credit according to work done.

PHYS832 Theory of Solids I (3 Credits)
Advanced topics in the quantum theory of solids from such fields as band structure calculations, optical properties, phonons, neutron scattering, the dynamics of electrons in one-band theory, the Landau Fermi Liquid Theory, charged Fermi liquids, the Fermi surface (surface impedance, cyclotron resonance, the DeHaas-Van Alphen Effect, etc.).
Prerequisite: PHYS623.
Corequisite: PHYS625.

PHYS838 Special Topics in Experimental Solid State Physics (1-4 Credits)
Credit according to work done.

PHYS839 Special Topics in Theoretical Solid State Physics (1-4 Credits)
Credit according to work done.

PHYS849 Special Topics in Theoretical Nuclear Physics (1-4 Credits)
Credit according to work done.

PHYS851 Advanced Quantum Field Theory (3 Credits)
Renormalization, unitarity, gauge theory, S-matrix construction.
Prerequisite: PHYS624.

PHYS858 Special Topics in Elementary Particles and Quantum Field Theory (1-4 Credits)
First semester.
Prerequisite: PHYS752 and PHYS851.

PHYS859 Special Topics in Elementary Particles and Quantum Field Theory (1-4 Credits)
Credit according to work done.

PHYS869 Special Topics in Plasma Physics (1-4 Credits)
Credit according to work done.

PHYS878 Special Topics in Space and Cosmic Ray Physics (1-4 Credits)
Credit according to work done.

PHYS879 Special Topics in General Relativity (1-4 Credits)
Credit according to work done.

PHYS888 Special Topics in Applied Physics (2 Credits)

PHYS889 Special Topics in Interdisciplinary Problems (1-4 Credits)
Credit according to work done.
Restriction: Permission of instructor.

PHYS898 Pre-Candidacy Research (1-8 Credits)

PHYS899 Doctoral Dissertation Research (1-8 Credits)