

# Physics

Assistant Professor Leah E. Simon (Chair)

**Departmental Mission Statement:** The Ripon College Physics Department engages students in the understanding of the physical world and enhances students' awareness of the critical role of physics in modern society. The Physics Department equips students to identify and effectively implement the scientific method, critically analyze scientific arguments, identify and solve analytic problems, synthesize complex information and communicate effectively both orally and in writing through the study of physical phenomena.

**Communicating Plus - Physics:** Students completing a minor in physics develop skills in four Communicating Plus areas: problem solving, written communication, oral communication, and critical thinking. These skills develop in all courses required for the minor and are refined with experience. Solving problems systematically is a significant component of each physics course and the mathematical sophistication of problem solutions as part of written assignments and laboratory work increases from first-year work to sophomore and junior courses. Students are given opportunities to apply use of numerical methods and computer modeling as well as differential and integral calculus, algebra, and analytic geometry to the solution of problems. Error analysis is a vital part of laboratory work from the very beginning. By the time students are working in the Modern Physics or other advanced laboratory setting, they are expected to apply their understanding of error analysis to experimental design. Most written communication requires the integration of mathematical expressions, figures, tables, and other graphics into text. Students are expected to practice combining these elements not only in laboratory reports but also in problem solution papers. As students progress from first-year to more advanced courses, their reports increase in length, detail, and mathematical sophistication. More emphasis is placed on derivations as well as on literature searches for background. Critical thinking is central to effective experimental design. Oral communication in beginning courses occurs mostly among peers during group laboratory and problem-solving sessions. Some quizzes make use of group formats to encourage effective exchange of ideas. A poster session during the first-year and Power Point presentations of projects in advanced courses help develop both oral communication and graphics skills.

**Requirements for a minor in physics:** 22 credits and 8 prerequisite credits. MTH 201 and 202 are prerequisites for PHY 251.

**Required:** PHY 171, 172, and 251. Eight additional credits in physics courses numbered above 200, including no more than five credits from PHY 412/CHM 333 (five credits) and PHY 333/CHM 334 (five credits) and no more than four credits from PHY 230, 360, 362 (four credits each) and PHY 200 (two-four credits).

**Requirements for a minor in astronomy:** 22 credits and 8 prerequisite credits. MTH 201 and 202 are prerequisite for PHY 251.

**Required:** PHY 171, 172, and 251. Eight additional credits may be chosen from the following options: PHY 200, 230, 360, or 362.

## 120. Astronomy

Simon

Four credits.

This course offers a brief historical development of astronomy and explores the properties of light and light sources, astronomical instrumentation, properties of stars, stellar evolution, galaxies and cosmology. The course includes laboratory introduction to telescopes, optical spectra, and the night sky. Activities include lecture, laboratory, and projects.

## 171. General Physics I

Simon

Five credits. Offered fall semester yearly.

Calculus based. Mechanics: linear and rotational motion, forces, momentum, work and energy. Lecture, laboratory, and problem-solving sessions.

*Corequisite: MTH 201 or consent of the instructor.*

## 172. General Physics II

Simon

Five credits. Offered spring semester yearly.

Calculus based. Thermodynamics, electricity, electromagnetism, waves and optics. Lecture, laboratory, and problem-solving sessions. *Prerequisite: PHY 171, MTH 201 or consent of the instructor. Students interested in engineering and/or considering courses in physics beyond the introductory sequence are strongly encouraged to enroll concurrently in MTH 202.*

## 200. Topics in Astronomy

Staff

Variable credit course, 2-4 credits.

Special topics in astronomy not covered by regular courses. This course may be repeated for credit when topics change. Please see the pertinent Schedule of Courses for listing of topics courses and other possible prerequisites. *Prerequisites: PHY 172 and consent of the instructor.*

- 230. Optics** **Simon**  
Four credits.  
Topics include geometric and wave optics, lasers, polarimetry, holography and matrix methods. Lecture and laboratory experimentation. *Prerequisites: PHY 172 and MTH 202, or consent of the instructor.*
- 251. Modern Physics** **Simon**  
Four credits. Offered fall semester yearly.  
Historical development of quantum physics. Introduction to quantum mechanics, structure and behavior of atoms, nuclei and solids, special and general relativity, quantum statistics. Applications of modern physics to current technology. Lecture, laboratory, and problem-solving sessions.  
*Prerequisites: PHY 172 and MTH 202, or consent of the instructor.*
- 300. Departmental Studies** **Staff**  
Variable credit course, 2-4 credits.  
Special subjects in physics not covered by regular courses. This course may be repeated for credit when topics change. Please see the pertinent Schedule of Courses for the listing of topics courses and possible prerequisites. *Prerequisites: PHY 172 and consent of the instructor.*
- 310. Aerospace Studies Seminar** **Staff**  
One credit each semester.  
Can be taken more than once for credit. Enrollment for credit limited to students with NASA Wisconsin Space Grant Consortium (WSGC) undergraduate scholarship. Grading is S-U.
- 330. Advanced Mechanics** **Staff**  
Four credits. Offered spring 2017.  
Topics include kinematics and dynamics of particles and rigid bodies, oscillations, central-force motion, rockets, collisions, Lagrangian mechanics. Lecture, problem-solving sessions, and projects. *Prerequisites: PHY 171 and MTH 202, or consent of the instructor.*
- 334. Thermodynamics and Statistical Physics** **Scanlon**  
Five credits. Offered spring semester yearly.  
The study of chemical and physical thermodynamics and its applications to chemistry, biochemistry and idealized physical systems (power plants and engines). Kinetics of reactions, reaction mechanisms, and reaction rate theory are also covered. Laboratories illustrate and test established principles and provide basic experience with measurements yielding quantitative results. Same as CHM 334. *Prerequisites: MTH 202 and PHY 171 and 172, or consent of the instructor.*
- 340. Electricity and Magnetism** **Simon**  
Four credits.  
Electrostatics, magnetostatics, development and application of Maxwell's equations to systems including wave optics. Lecture, problem-solving sessions, individual and group projects. *Prerequisites: PHY 251; Corequisite: MTH 206 or consent of the instructor.*
- 360. Astrophysics I: Stars and Interstellar Medium** **Simon**  
Four credits. Offered spring 2017 and alternate years.  
This course includes an introduction to astronomical methodology, stars and the interstellar medium. Astronomical techniques, stellar structure and evolution and the interstellar medium are emphasized. The course explores a laboratory introduction to astronomical observation. *Prerequisite: PHY 251 or consent of the instructor.*
- 362. Astrophysics II: Galaxies and Cosmology** **Simon**  
Four credits. Offered spring 2018 and alternate years.  
This course includes an introduction to astronomical methodology and cosmology. Astronomical techniques, galactic structure, quasars and cosmology are emphasized. *Prerequisite: PHY 251 or consent of the instructor.*
- 401. The Teaching of Physics** **Staff**  
Two credits. Offered as needed.  
Methods of teaching physics in secondary schools. Development of laboratories, lectures, problems, evaluations, demonstrations. Laboratory safety. Required for licensure in physics.

**412. Quantum Mechanics****Scanlon**

Five credits.

An introduction to quantum mechanics with applications in spectroscopy. Bonding theory, atomic and molecular structure determinations, and quantum chemistry calculations are included. Laboratories are in the area of chemical quantum mechanics calculations, spectroscopy, and structure determination. Same as CHM 333. *Prerequisites: MTH 202; and PHY 171 and 172 or consent of the instructor.*

**440. Advanced Laboratory and Computational Physics****Staff**

Four credits.

Laboratory and computational projects to investigate complex physical systems and learn to use new laboratory instruments and data analysis techniques. Experimental design and mathematical modeling. Introduction to numerical methods and application of numerical models to explore problems such as fluid dynamics, stochastic processes, and electronic structure. *Prerequisite: PHY 251 or consent of the department chair.*

**501, 502. Senior Seminar****Staff**

Two credits each semester. May be taken twice for credit. Offered on demand for senior physics majors. (2016-17 academic year).

Development of senior thesis project, presentations of research results. Grading is S-U. Same as MTH 501/502. *Prerequisites: PHY 251, senior standing, consent of the department chair, and 12 credits toward the major.*

**540. Independent Study****Staff**

Variable credit course, 2-4 credits. Offered on demand.

No more than twelve credit hours of independent study or internship may be taken, and no more than eight credit hours may be in one department. A registration form is required. *Prerequisites: PHY 251, junior or senior standing, consent of the department chair and a department project director.*