

## **VARSIY SPORTS**

Hollins University is a member of the ODAC and NCAA Division III. We compete locally as well as regionally. Tryouts are open to all interested students. Student athletes practice/compete five to six days a week in individual sport seasons.

**PHED 300: VARSITY BASKETBALL**

**PHED 325: VARSITY GOLF**

**PHED 330: VARSITY LACROSSE**

**PHED 340: VARSITY RIDING**

**PHED 345: VARSITY SOCCER**

**PHED 360: VARSITY SWIMMING**

**PHED 370: VARSITY TENNIS**

**PHED 380: VARSITY VOLLEYBALL**

**Phillips**

**Mannino**

**Polito**

**Peterson, Courter, Gerald**

**O'Keeffe, Moore**

**Raines**

**Bernard**

**Kozak**

# Physics

**MAJOR, MINOR**

**PROFESSOR:** Bansi Kalra (chemistry)

**ASSISTANT PROFESSOR:** Marshall Bartlett (chair)

**VISITING ASSISTANT PROFESSOR:** Jianing Han

“Look deeply into nature and you will understand everything better,” said Albert Einstein. Students of physics at Hollins understand the truth of this maxim. Through their investigations of laws that underlie reality, they gain a greater appreciation not only of our universe, but also their relationship to it.

In physics courses at Hollins, you'll engage the ideas of Newton and Hamilton, Maxwell and Einstein, among many others. You'll find that wrestling with tough questions and exploring the limits of what is known about the world is the physicist's stock-in-trade and that there is a joy in understanding nature that comes from truly seeing it for the first time.

Classes are intimate: upper-division classes typically have 3-4 students and lower-division courses have 10-15. We place great value on nurturing each student's development as a physical thinker. In physics courses at Hollins you'll find yourself challenged and closely supported and nurtured as you mature in your physical reasoning.

## **REQUIREMENTS FOR A MAJOR IN PHYSICS:**

10 courses and their corresponding laboratories (48 credits)

- PHYS 201, 201L: Analytical Physics I, Lab (4, 2)
- PHYS 202, 202L: Analytical Physics II, Lab (4, 2)
- PHYS 301: Classical Mechanics (4)
- PHYS 302: Electromagnetism (4)
- PHYS 310: Modern Physics (4)
- PHYS 331, 331L: Physical Chemistry I, Lab (4, 2)
- PHYS 332, 332L: Physical Chemistry II, Lab (4, 2)
- PHYS 335: Quantum Mechanics (4)
- PHYS 470: Physics Research Seminar (4)
- PHYS 480: Senior Thesis (4) or PHYS 490: Senior Honors Thesis (4, 4)
- Proficiency in mathematics is required for all physics major courses. Courses in statistics and computer science are highly recommended. The Short Term

## **PHYSICS** continued

in the senior year is normally devoted to research in physics or a closely related field. Prerequisites for any course may be satisfied by examination.

- A student with a score of 4 or 5 on the College Entrance Examination Board (CEEB) Advanced Placement Test in physics will receive four credits in physics and may be permitted to enroll in PHYS 201, 202 during their first year. Prospective majors and minors and majors who wish to apply for participation in the Honors Program should consult the chair of the department.

## **REQUIREMENTS FOR A MINOR IN PHYSICS:**

5 courses and the corresponding laboratories (24–28 credits) from:

- PHYS 201, 201L: Analytical Physics I, Lab (4, 2)
- PHYS 202, 202L: Analytical Physics II, Lab (4, 2)
- PHYS 301: Classical Mechanics (4)
- PHYS 302: Electromagnetism (4)
- PHYS 310: Modern Physics (4)
- PHYS 331, 331L: Physical Chemistry I, Lab (4, 2)
- PHYS 332, 332L: Physical Chemistry II, Lab (4, 2)
- PHYS 335: Quantum Mechanics (4)

For all laboratories offered in the physics department, the corresponding lecture course is a corequisite or prerequisite.

## **COURSES IN PHYSICS:**

### **PHYS 101: INTRODUCTION TO ASTRONOMY (4)**

**Department**

A course in astronomy dealing with the physical principles and scientific investigation of objects in our solar system. The course will emphasize the study of stars, star systems, cosmology, and relativity; and how knowledge is acquired of celestial objects to develop models of our universe. Will include observation of nearby stars. Open to first-year students and the nonscientist. No prerequisite. Not offered in 2011–12. (SCI)

### **PHYS 108: BASIC ELECTRONICS (4)**

**Department**

A course that combines a lecture and lab approach. Basic electronic concepts, static electricity to solid-state electronics will be taught in lectures. Analog and digital circuit fundamentals will be emphasized in the laboratory sections. Open to first-year students. No prerequisite. Not offered in 2011–12. (SCI)

### **PHYS 121: INTRODUCTION TO OCEANOGRAPHY/HYDROGEOLOGY (4)**

**Department**

In this course we discuss the principles of physical, chemical, biological, and geological oceanography and hydrogeology. The course explores the dynamics and evolution of the oceans/ocean basins. Also, the course examines the occurrence, characteristics, movement, quality, development, and contamination of the Earth's water systems. These principles will be applied to water pollution, toxic waste, deforestations, soil erosion, biodiversity, and global warming. Also listed as ES 121. Prerequisite: *q*. Open to first-year students. Not offered in 2011–12. (Q, SCI)

### **PHYS 151, 152: PHYSICAL PRINCIPLES I, II (4, 4)**

**Han**

Noncalculus-based general physics with an emphasis on problem-solving, primarily intended for science and pre-medical students. PHYS 151 covers Newtonian mechanics, thermal physics, fluid physics, and wave motion. Topics in PHYS 152 include electricity, magnetism, DC/AC circuits, light and optics, special

relativity, and quantum physics. Open to first-year students. Prerequisite: MATH 140. PHYS 151 Offered Term 1. PHYS 152 Offered Term 2. (SCI: must take lab to fulfill SCI)

**PHYS 151L, 152L: PHYSICAL PRINCIPLES I, II LAB (2, 2)** **Han**  
Open to first-year students. Prerequisite: *q*. Corequisite: PHYS 151 or 152. Offered both terms. (Q, SCI)

**PHYS 201, 202: ANALYTICAL PHYSICS I, II (4, 4)** **Bartlett**  
A rigorous calculus-based introduction to classical mechanics, gravitation, and electricity and magnetism. Open to first-year students with advanced placement. Prerequisites: *q* and MATH 241 and 242 but may be taken concurrently with permission. PHYS 201 Offered Term 1. PHYS 202 Offered Term 2. (SCI: must take lab to fulfill SCI)

**PHYS 201L, 202L: ANALYTICAL PHYSICS I, II LAB (2, 2)** **Bartlett**  
Open to first-year students with advanced placement. Prerequisite: *q*. Corequisite: PHYS 201 or 202. Offered both terms. (Q, SCI)

**PHYS 221: SURVEY OF PHYSICS AND THE ENVIRONMENT (4)** **Bartlett**  
This course explores physics concepts and their connectedness to society and environmental issues. Topics include fossil fuel and nuclear energy, alternative energy sources, energy efficiency, climate change, earth's water systems, biodiversity, and others. Also listed as ES 221. Prerequisite: *q* and ES 117. Open to first-year students. Offered Term 2. (Q)

**PHYS 241: GEOLOGY AND EARTH HISTORY (4)** **Bartlett**  
Planet Earth's development as an integrated physical, chemical, and biological system over the past 4.6 billion years. Topics include: the origins of the solar system, Earth, and Moon; forces driving Earth's chemical and geological differentiation; plate tectonics; origins of life and humans; Earth's system dynamics; humans as geological agents; and Earth's climate system. Also listed as ES 241. Open to first-year students. Prerequisite: *q*. Offered Term 1. (SCI)

**PHYS 290: INDEPENDENT STUDY (2 or 4)** **Department**  
Individual study, reading, and either experimental or theoretical investigation of a physics-related topic below the advanced level. Each course occupies one term and may be offered during the summer. Up to three courses in the sequence may be taken for credit.

**PHYS 301: CLASSICAL MECHANICS (4)** **Bartlett**  
An extension of PHYS 201/202. Topics include Newton's Law, the simple harmonic oscillator, the central force problem, multiparticle system (coupled oscillators), rigid bodies, mechanics of continuous media, Lagrange and Hamiltonian Mechanics, and tensors. Prerequisite: PHYS 201. Offered Term 2.

**PHYS 302: ELECTROMAGNETISM (4)** **Bartlett**  
Intermediate-level electricity, magnetism, and the Maxwell equations of the electromagnetic field. Topics include charged-particle trajectories, the theorems of Gauss and Stokes, vector calculus, Poynting vector, wave and polarization phenomena, and electromagnetic interactions with matter. Prerequisites: PHYS 201 and PHYS 202. Offered Term 1.

**PHYS 310: MODERN PHYSICS (4)** **Han**  
Twentieth-century development in physics: relativity theory, the nature of space and time, the equivalence of mass and energy, introductory quantum theory,

**PHYSICS** continued

the particle nature of light, the wave nature of electrons, atomic and molecular structure, and the structure of the nucleus. Prerequisites: PHYS 201 and PHYS 202. Offered Term 1.

**PHYS 331, 332: PHYSICAL CHEMISTRY I, II (4, 4)** **Kalra**

Also listed and described as CHEM 331, 332. PHYS/CHEM 331 Offered Term 1. PHYS/CHEM 332 Offered Term 2.

**PHYS 331L, 332L: PHYSICAL CHEMISTRY I, II LAB (2, 2)** **Kalra**

Also listed and described as CHEM 331L and 332L. PHYS/CHEM 331L Offered Term 1. PHYS/CHEM 332L Offered Term 2.

**PHYS 335: QUANTUM MECHANICS (4)** **Han**

A rigorous introduction to the principles of quantum mechanics. Solutions of the Schrodinger equation, harmonic oscillator, and hydrogen atom. Operator methods are introduced and used to compose both orbital angular momentum and spin. Various approximation schemes will be studied. Also listed as CHEM 335. Prerequisites: PHYS 301, PHYS 302, or PHYS 331, PHYS 332; MATH 254, MATH 255, and MATH 316 or the equivalents are advised as preparation. Offered Term 2.

**PHYS 390: INDEPENDENT STUDY (2 or 4)** **Department**

Individual study, reading, and either experimental or theoretical investigation of a physics-related topic at the advanced level. Each course occupies one term and may be offered during the summer. Up to three courses in the sequence may be taken for credit.

**PHYS 399: INTERNSHIP (4)** **Department**

May be proposed in any term.

**PHYS 470: PHYSICS RESEARCH SEMINAR (4)** **Department**

A participatory seminar course examining current research areas in physics. Required of senior physics majors; other junior and senior science majors may enroll with permission. All course members will present and defend their physics-related research. A critical term paper is required. Prerequisite: junior or senior standing.

**PHYS 480: SENIOR THESIS (4)** **Department**

A research paper of publication quality based upon research in physics, or a physics-related field, undertaken for one term plus Short Term during the senior year. Required of all senior physics majors.

**PHYS 490: SENIOR HONORS THESIS (4, 4)** **Department**

By invitation of the department. Application must be made with faculty prior to registration. Required both regular terms and Short Term.