Did you know that the University of Kansas
Department of Physics and Astronomy . . .
• has a talented and energetic faculty working in numerous fields of research?
• has tripled its external research funding in the last decade?
• supports all of its full-time graduate students financially?
• ranks in the top fifth of US university physics and astronomy departments in quality of productivity of research, by several independent measures, including the National Research Council?

Degrees Offered
• Ph.D. in Physics
  Including a unique Multidisciplinary plan that facilitates interaction and inclusion of other areas of science.
• M.S. in Physics
  • M.S. in Physics, emphasis in Computational Physics and Astronomy (for students interested in the application of computers to problem solving in the physical sciences)

Preparation for Admission
Normal admission requires a grade-point average of 3.0 or higher. A degree in physics is desirable but not required. Preparation should include junior/senior-level courses in mechanics, electrodynamics, quantum mechanics, thermal physics, and laboratory skills. Math preparation should include linear algebra, vector calculus, and ordinary differential equations. Knowledge of an advanced programming language is helpful. Students with less preparation may take most of the necessary courses for graduate credit. Many students enroll in math and computer science courses to supplement their research skills for graduate study and future employment opportunities.

Application Materials
• Deadline for spring semester: November 15
• Deadline for fall semester: May 1 (domestic)
• Deadline for fellowship consideration for fall semester: December 31
• In all cases we may consider exceptional applications past the deadline date.
  Complete application instructions can be found on our website. The application for admission must be submitted online. The requirements are located at: http://www.phys.ku.edu/physicsgraduate/about.shtml
  The online application is available at: http://www.graduate.ku.edu
  For all students, the GRE PHYSICS is very strongly recommended.
  E-mail: physics@ku.edu
  Web site: http://www.physics.ku.edu/

Financial Support
Currently, most of our students receive support—about 90 percent from teaching assistantships, 40 percent from research assistantships, and so percent from fellowships or other sources.

Teaching Assistantships
Beginning graduate students may be offered half-time appointments, primarily for teaching undergraduate labs. Tuition is waived for half-time teaching assistants. Students whose native language is not English must achieve a score of at least 50 on the Test of Spoken English or pass the SPEAK test at KU’s Applied English Center to be eligible for teaching assistantships.

Research Assistantships
Most research groups have federal or state grants that support research assistantships.

Research Programs
A brief overview of our research programs is presented in this brochure.

Astrobiophysics
KU physicists lead a multidisciplinary collaboration including paleontologists, atmospheric scientists, geologists, astronomers, and others in studying effects on Earth’s biosphere from energetic astrophysical radiation events, such as gamma-ray bursts, solar flares, and enhanced cosmic rays. The award-winning work has verified the existence of a 62-million-year cycle in biodiversity of unknown origin, which they are working to understand.

Astronomy
One set of astronomy faculty at KU study stellar populations, inside and outside our galaxy, using the photometry of individual stars and star clusters to constrain models of stellar evolution, and study the polarization of light from dust within and around cool evolved stars. Others study the evolution of galaxies by observing them at different redshifts, or ages of the universe, and comparing them with theoretical models of galaxy formation. They also study how galaxy properties depend on the environment, or local galaxy density, in which they live. All of these studies are primarily observational in nature and use both space-based and ground-based national telescope facilities.

Biophysics
Biophysics research at KU investigates how the properties and activities of biological molecules affect cellular processes. Research uses quantitative physical methods including biochemical, spectroscopic, and single molecule techniques to probe the thermodynamics, structural dynamics, and kinetics of biomolecules. Current research includes the structure and dynamics of DNA and the molecular motors that manipulate DNA. A major emphasis is the development of new biophysical models and experimental techniques.
Condensed Matter Physics — Experimental

Students and faculty are active in high-Tc superconductivity, including fundamental physics and applications such as the high-power electrical transmission and electronic devices; the physics and applications of macroscopic quantum devices and circuits, such as quantum coherence and quantum computing, in synthesis nanomaterials and nanodevices; and on ultralast processes in semiconductor nanostructures. On-campus research efforts include thin-film growth, device fabrication, and a variety of electronic and optical techniques for characterizing and improving materials to develop high performance devices.

Cosmology

KU’s cosmology researchers concentrate on many aspects of the large-scale structure of the universe and its constituents. These include theoretical, statistical, and numerical studies of the distribution and dynamics of galaxies, clusters, and voids both in the nearby and the high redshift universe. Activities include inquiries into the substructure of large almost empty regions we see in both simulations and observations, the effect of neutrino masses on large-scale dynamics in the universe, the effects of cluster motion on the microwave background radiation, the geometry and topology of galaxies and the large-scale-structure, among other related topics.

High Energy Physics — Experimental

KU researchers work on particle physics experiments at CMS at CERN’s LHC and the proposed next-generation linear electron-positron collider (ILC) project. They are involved in cosmic ray astrophysics experiments at the South Pole and elsewhere. Activities include electronics development for pixel detectors, ILC detector development, and physicsgerät from CMS, D0, CLEO, and particle astrophysics data. Physics topics under study include investigation of the top quark, searches for the Higgs boson and new phenomena, and investigation of ultra-high energy particles.

High Energy Physics — Theoretical

The particle theory group works on anything under the scope of “new physics,” as well as Standard Model questions. Theorists make new theories and test theories against laboratory and astrophysical data. Neutrinos in every energy regime, the connection between quantum gravity and the highest energy cosmic rays, astrophysics applications, and cosmology have been the topics of recent publications. QCD and collider physics are another continual interest. The KU theory group helped initiate the ambitious RICE project, in which it participates actively.

Nonlinear Dynamics — Theoretical

Theoretical studies of nonlinear dynamics are concentrated on the theoretical understanding, computer simulation, and development of methods for controlling nonlinear instabilities of high-energy particle beams in large particle accelerators. Major topics include the development of nonlinear correction schemes for the compensation of adverse nonlinear fields in large accelerators and the study of chaotic coherent beam oscillations in storage-ring colliders.

This work is applied to the LHC at CERN, the Tevatron upgrade at Fermilab, and the HERA Upgrade at DESY.

Nuclear Physics

KU researchers use experiments and simulations to understand the nature of the universe at a microscopic level through the Big Bang. At this time, the universe consisted of a soup of quarks and gluons where matter and antimatter were in balance, and left- and right-handed quarks behaved similarly. As the quark soup expanded and cooled and condensed into protons and neutrons, proton matter came to dominate antimatter, and left- and right-handed quarks began to behave in very different ways. To make this study, we create “little bangs” by colliding the nuclei of Gold atoms together at almost the speed of light. This has been done at RHIC on Long Island and is in process at LHC at CERN in Geneva. We are deeply involved in analysis for RHIC, with a special emphasis on how quarks and gluons flow when they are under pressure. At the LHC, we serve as the lead institution for building the zero degree calorimeter for the CMS experiment and are presently moving to data analysis.

Space Physics and Plasma Astrophysics

KU scientists are involved with projects on several space missions, including Galileo, Geotail, and Ulysses, and the energetic particle and mass spectrometer experiments on the Cassini mission to Saturn and Titan. Activities include theoretical, computational, and data analysis investigations into space plasma environments and solar wind. The emphasis is on modeling processes that cause particle acceleration and redistribution in planetary magnetospheres and on processes responsible for solar wind and cosmic rays. KU researchers are undertaking studies in plasma astrophysics such as the modeling of gamma ray bursts.