TOEFL requirements
The TOEFL exam is required for students from non-English-speaking countries.
- PBT score: 550
- iBT score: 79
The IELTS and Pearson Test of English are also accepted. See http://www.k-state.edu/grad/admissions/application-process/international/index.html#English-Proficiency-Requirements for minimum scores.

Other admissions information
Additional requirements: Candidates with engineering or mathematics degrees will also be considered.
- Undergraduate preparation assumed: Mechanics (3 to 6 hours); Physics Lab (6 hours); Electricity and Magnetism (3 to 6 hours); Modern Physics (3 hours); Quantum Mechanics (3 hours); Mathematics through Differential Equations and Vector Analysis.

TUITION
Tuition year 2016–17:
- Tuition for in-state residents
  - Full-time students: $4,029 per semester
  - Part-time students: $402.90 per credit
- Tuition for out-of-state residents
  - Full-time students: $9,095 per semester
  - Part-time students: $909.50 per credit
Graduate assistants pay resident fees; tuition is waived for graduate and research teaching assistants. Students pay campus privilege fees and course enhancement fees.
- Credit hours per semester to be considered full-time: 6
- Deferred tuition plan
- Health insurance: Available at the cost of $348 per year.
- Other academic fees: Full-time tuition rates include fees and required additional assessments. Campus privilege and health fees are to be paid out-of-pocket by graduate assistants. Campus privilege fees are $1075.50 annually based on 20 credit hours per academic year while health insurance is $348.00 per calendar year.
- Academic term: Semester

Number of first-year students who received full tuition waivers: 14

Teaching Assistants, Research Assistants, and Fellowships
- Number of first-year
  - Teaching Assistants: 13
  - Research Assistants: 1
  - Fellowship students: 4
- Average stipend per academic year
  - Teaching Assistant: $18,000
  - Research Assistant: $18,000
  - Fellowship student: $23,000
Figures listed above are 9 month academic salaries and do not include 6 bi-weekly pay periods of salary for RAs or 4 weeks for TAs in the summer.

FINANCIAL AID
Application deadlines
- Fall admission:
  - U.S. students: March 1
Kansas

Loans
Loans are available for U.S. students.
Loans are not available for international students.
GAPS/SA application required: No
FAFSA application required: Yes

For further information
Address financial aid inquiries to: Office of Student Financial Assistance, 104 Fairchild Hall, Kansas State University, Manhattan, KS 66506.
Phone: (785) 532-6420
E-mail: finaid@k-state.edu
Financial aid website: http://www.k-state.edu/sfa/

HOUSING

Availability of on-campus housing
Single students: Yes
Married students: Yes

For further information
Address housing inquiries to: Department of Housing & Dining Services, 104 Pittman Building, Kansas State University, Manhattan, KS 66506.
Phone: (785) 532-6453
E-mail: housing@ksu.edu
Housing aid website: http://www.housing.k-state.edu/

Table A—Faculty, Enrollments, and Degrees Granted

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>2015–16 Faculty</th>
<th>Enroll Fall 2015</th>
<th>Number of Degrees Granted 2015–16 (2011–16)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Master's</td>
<td>Doctorate</td>
<td>Master's</td>
</tr>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td>11 1 22</td>
<td>(1)</td>
<td>1(8) (17)</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td>6 3 10</td>
<td>1(4)</td>
<td>2(8)</td>
</tr>
<tr>
<td>Cosmology &amp; Particle Astrophysics</td>
<td>2 1 -</td>
<td>-</td>
<td>-(2) -(2)</td>
</tr>
<tr>
<td>High Energy Physics</td>
<td>5 - 5</td>
<td>-</td>
<td>1(7)</td>
</tr>
<tr>
<td>Physics and other Science Education</td>
<td>2 - 4</td>
<td>-(1)</td>
<td>-(1) 1(6)</td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
<td>12 -</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>5</td>
<td>53 (2) 2(19) 4(37)</td>
</tr>
<tr>
<td>Full-time Grad. Stud.</td>
<td>5 53</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>First-year Grad. Stud.</td>
<td>12</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

GRADUATE DEGREE REQUIREMENTS

Master's: Thirty graduate credits in approved program with satisfactory performance and "B" average in coursework are required. Thesis is required for which up to six credits may be earned. Examination over thesis and one academic year of residence are also required.

Doctorate: Ninety graduate credits in approved program of study with satisfactory performance with a "B" average in coursework is required. Preliminary examination in area of specialization and related fields is required. Dissertation for which 30 credits may be earned, oral examination, and one full year of residency are also required.

Thesis: Thesis may be written in absentia.

SPECIAL EQUIPMENT, FACILITIES, OR PROGRAMS

Ultrafast Ti:Sapphire laser systems for studies of the interaction of high-intensity ultrafast electromagnetic pulses with matter, Cr: Forsterite and fiber lasers for studies of optical frequency standards, and a 30-keV ECR ion source for ion research in atomic, molecular, and optical physics. Linux computer clusters are available for large-scale computational studies. State-of-the-art laser laboratories equipped with argon ion, Nd:YAG, and dye lasers and Raman, Fabry-Perot, and correlation spectrometers. Laboratories for the study of soft condensed matter include extensive static and dynamic light scattering facilities; a broad array of microscopies including atomic force, fluorescence, Raman, and reflection interference contrast; surface ellipsometry and wetting apparatus; and a synthetic chemistry lab.

Table B—Separately Budgeted Research Expenditures by Source of Support

<table>
<thead>
<tr>
<th>Source of Support</th>
<th>Departmental Research</th>
<th>Physics-related Research Outside Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal government</td>
<td>$5,594,471</td>
<td></td>
</tr>
<tr>
<td>State/local government</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-profit organizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business and industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$5,594,471</td>
</tr>
</tbody>
</table>

Table C—Separately Budgeted Research Expenditures by Research Specialty

<table>
<thead>
<tr>
<th>Research Specialty</th>
<th>No. of Grants</th>
<th>Expenditures ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atomic, Molecular, &amp; Optical Physics</td>
<td></td>
<td>$4,278,605</td>
</tr>
<tr>
<td>Condensed Matter Physics</td>
<td></td>
<td>$221,130</td>
</tr>
<tr>
<td>Combined with Cosmology</td>
<td></td>
<td>$974,286</td>
</tr>
<tr>
<td>Physics and other Science Education</td>
<td></td>
<td>$220,450</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$5,694,471</td>
</tr>
</tbody>
</table>

FACULTY

Distinguished University Professor

Ben-Itzhak, Itzik, Ph.D., Technion, Haifa, 1986. Atomic, Molecular, & Optical Physics. Experimental AMO physics; imaging dissociation and ionization of molecular ions by ultrafast intense laser pulses; imaging fragmentation of molecular-ion beams induced by slow collisions with atomic targets.


Lin, Chi-Dong, Ph.D., University of Chicago, 1974. Atomic, Molecular, & Optical Physics. Theoretical studies of laser-molecule interactions; astrosecond physics; few-body physics; atomic collisions; dynamic chemical imaging.


Professor


Chakrabarti, Amitabha, Ph.D., University of Minnesota, 1987. Department Head. Condensed Matter Physics. Theoretical and computational studies in soft-condensed matter and bi-
ological physics including self-assembly of nanoparticles, colloids, proteins, and aerosols.

**Corwin, Kristan, Ph.D., University of Colorado Boulder, 1999.** *Atomic, Molecular, & Optical Physics*. Experimental atomic physics; optical frequency metrology; ultrafast optics; laser development.

**DePaola, Brett D., Ph.D., University of Texas, Dallas, 1984.** *Atomic, Molecular, & Optical Physics*. Experimental atomic physics; crossed beams; laser-beam interactions.

**Law, Bruce M., Ph.D., University of Victoria, 1985.** *Condensed Matter Physics*. Condensed matter interfaces; nonequilibrium liquids.


**Thumm, Uwe, Ph.D., University of Freiburg, 1989.** *Atomic, Molecular, & Optical Physics*. Theoretical atomic, molecular, optical, and surface physics. Numerical modeling of electronic excitation, electron-transfer, and fragmentation processes in interactions of intense light in the IR to XUV spectral range with atoms, ions, molecules, clusters, nanostructures, and solid surfaces.

**Weaver, O. Lawrence, Ph.D., Duke University, 1970.** *Theoretical Physics*. General theoretical physics.

**Wysin, Gary M., Ph.D., Cornell University, 1985.** *Condensed Matter Physics*. Condensed matter theory; nonlinear magnetic excitations; magnetic vortices; electromagnetics.

**Associate Professor**

**Berg, Matthew J., Ph.D., Kansas State University, 2008.** *Applied Physics, Other*. Electromagnetism; atomic, molecular & optical physics; optics; holography.

**Flanders, Bret, Ph.D., University of Chicago, 1999.** *Biophysics, Condensed Matter Physics*. Soft-matter nanotechnology and biological physics.


**Ivanov, Andrew G., Ph.D., University of Rochester, 2004.** *High Energy Physics*. Experimental high-energy research aimed at pursuing searches for new phenomena at the Large Hadron Collider (LHC).

**Kumarappan, Vinod, Ph.D., Tata Institute of Fundamental Research, 2002.** *Atomic, Molecular, & Optical Physics*. Strong field alignment and orientation of molecules; experimental atomic, molecular, and optical physics.

**Maravin, Yuri, Ph.D., Southern Methodist University, 2002.** *High Energy Physics*. Experimental high-energy physics.

**Sayre, Eleanor, Ph.D., University of Maine, 2007.** *Physics and other Science Education*. Student identity development in STEM; interplay between physics and math understanding; cognitive and cultural models of learning; faculty development in research-based teaching and assessment; qualitative, quantitative, and mixed-methods research; and evidence-based curriculum development.

**Schmit, Jeremy D., Ph.D., University of California, Santa Barbara, 2005.** *Biophysics, Condensed Matter Physics*. Theoretical soft-matter physics and biological physics; protein phase behavior, self-assembly, and fibril formation; drug formulation.

**Trallero, Carlos, Ph.D., Stony Brook University, 2007.** *Atomic, Molecular, & Optical Physics*. Experimental atomic, molecular, and optical physics; strong-field molecular spectroscopy; higher-order harmonic generation; attosecond physics; coherent quantum control.

**Washburn, Brian R., Ph.D., Georgia Institute of Technology, 2002.** *Atomic, Molecular, & Optical Physics*. Nonlinear fiber optics; ultrafast optics; laser development; optical frequency combs; metrology.

**Assistant Professor**

**Kaadze, Ketino, Ph.D., Kansas State University, 2010.** *High Energy Physics*. Experimental high-energy particle physics.

**Laverty, James (J.T.) T., Ph.D., Michigan State University, 2013.** *Physics and other Science Education*. Particles and fields; high energy physics.

**Rudenko, Artem A., Ph.D., Moscow Institute of Physics & Technology, 2002.** *Atomic, Molecular, & Optical Physics*. Experimental atomic, molecular, and optical physics; ultrafast laser and free electron laser interactions with atoms and molecules; 3D imaging of fragmentation processes.

**Samushia, Lado, Ph.D., Kansas State University, 2009.** *Cosmology & String Theory*. Dark energy; models of gravity; large-scale structure of the Universe; galaxy clustering; galaxy surveys (DESI, EUCLID, LSST); observational tests of cosmological models; astrostatistics.

**Research Professor**

**Carnes, Kevin D., Ph.D., Purdue University, 1984.** *Atomic, Molecular, & Optical Physics*. Nuclear Physics. Experimental atomic, molecular, and optical physics; accelerator physics; computer controls.

**Research Associate Professor**

**Le, Anh-Thu, Ph.D., Belarusian State University, 1994.** *Atomic, Molecular, & Optical Physics*. Theoretical atomic physics.

**Research Assistant Professor**

**Fehrenbach, Charles, Ph.D., University of Michigan, 1993.** *Atomic, Molecular, & Optical Physics*. Experimental atomic, molecular, and optical physics.

**DEPARTMENTAL RESEARCH SPECIALTIES AND STAFF**

**Theoretical**

Atomic, Molecular, & Optical Physics. Interaction of intense femtosecond and attosecond light pulses with atoms, molecules, and surfaces. The group seeks to resolve in time and space the motion of electrons and nuclei during the fragmentation of molecules by intense, ultrashort laser light pulses. To this end, they work closely with the AMO experimentalists in the department and across the world, proposing new experiments and more efficient ways to generate the laser pulses themselves as well as helping to interpret experiments. Esry, Le, Lin, Thumm.

Condensed Matter Physics. Studies of magnetic models with pinned magnetic vortices; influence of impurity-pinned magnetic vortices on dynamic correlations; dipolar effects on pinned magnetic vortices; optical cavities; Monte Carlo simulations of phase transitions in XY-symmetry magnets with vacancies; theory for stability of singly-charged and doubly-charged vortices pinned on vacancies; development of projection quantum Monte Carlo schemes to calculate dynamic modes at fixed momentum for magnetic models. Wysin.

Cosmology & Particle Astrophysics. Dark energy; dark matter; classical cosmological tests; cosmic microwave background anisotropies; inflation; cosmological magnetic fields; developing models for the large-scale matter and radiation distributions in the universe. Testing these models by comparing their predictions to observational data, including the anisotropy in the cosmic microwave background radiation, and the mass correlation function; cosmological gravitational waves; large-scale structure. Ratra, Samushia.
Soft Condensed Matter and Biological Physics. Aggregation and self-assembly of colloids and proteins; protein crystallization; liquid mixtures including polymers, liquid crystals, aerosols, colloids, nanoparticles; protein phase behavior; amyloid fibril formation; drug formulations. Chakrabarti.

Experimental
Atomic, Molecular, & Optical Physics. Harmonic generation, AMO ultrafast, and attosecond science; collisions with MOT targets; collisions between molecular ions and atomic laser interactions with nano-structures and fast ion beams; laser metrology; fiber laser development; nonlinear fiber optics. Ben-Itzhak, Carnes, Corwin, Fehrenbach, Kumarappan, Rolles, Rudenko, Trallero, Washburn.

High Energy Physics. Energy frontier and intensity frontier physics; searches for new phenomena using the CMS detector at the CERN Large Hadron Collider; measurements of neutrino interactions using the MicroBooNE detector at Fermilab; searches for new physics at the Fermilab Mu2e experiment; development of next-generation pixel detectors, new instrumentation and algorithms for calorimetry, and advanced methods in detector and physics simulation; research in new directions for neutrino physics and collider physics. Bolton, Horton-Smith, Ivanov, Kaadze, Maravin.

Physics and other Science Education. Student identity development in STEM; interplay between physics and math understanding; cognitive and cultural models of learning; faculty development in research-based teaching and assessment; qualitative, quantitative, and mixed-methods research; and evidence-based curriculum development. Laverty, Sayre.

Soft Condensed Matter and Biological Physics. Soft-matter nanotechnology and biophysics; nano-electronic devices fabricated to measure electromechanical properties at selected sites on living cells; Liquid surface physics, thin films, surface and interfacial forces; Nanoparticle synthesis and solution behavior, light scattering by irregular particles, aerosols and gels. Berg, Flanders, Law, Sorensen.

View additional information about this department at www.gradschoolshopper.com