



## Physics Department 2007-2008 Annual Report

June 13, 2008

### Part 1: Executive Summary

The Physics Department continues on its trajectory to excellence in all three mission areas. In both our undergraduate and graduate programs, we are streamlining our core offerings in order to create openings for such topical courses as *Computational Physics* or *Biological Physics*. Our own undergraduates and an increasing number of summer interns avail themselves of research opportunities in the department. In the area of discovery, our research expenditures increased by 19% over FY 07, and physics faculty members have become highly sought after as partners on large center proposals. We continue to engage with the university and the broader community, through appearances in local and regional media, public lectures, events for alumni and friends, and a symposium on “Complex Materials” with international participation.

Two new faculty members joined us in 2007-08. Dr. Eric Sharpe, an experienced researcher and instructor from the University of Utah, was recruited as part of the computational science cluster. Dr. Sharpe is equally fluent in the languages of algebraic geometry, quantum field theory, and particle physics, whose confluence drives the most sophisticated advances in current theoretical physics. Dr. Arav joined us from the Department of Astrophysical and Planetary Sciences at the University of Colorado Boulder, where he served as a Research Professor. His work on quasar outflows probes the structure and behavior of the super massive black holes which are conjectured to form the center of these active galaxies. He adds much needed strength to our astronomy and astrophysics program. And finally, Dr. Patrick Huber, a young neutrino phenomenologist with an outstanding track record in impact studies of large-scale neutrino experiments will join our faculty in August 2008.

In the area of Learning, our student numbers continue to grow. Currently, 123 undergraduate physics majors and 67 graduate students are enrolled in our programs, compared to 112 and 58 for the previous year. In fact, seen over the past two years, our graduate enrollment has increased by 46%. It is also encouraging that the number and quality of applications, at both the graduate and undergraduate level, are continuing to increase. Various curricular changes were implemented this year, to enhance the preparation of our students for upper-level undergraduate courses, and to offer a wider selection of electives in emerging new fields. Most of these courses will be offered as conjoint 4000/5000 level courses, so as to enrich our graduate program as well. The Class of 2008 consisted of 14 students, and two PhD and seven MS degrees were awarded.

In the area of discovery, our research expenditures increased by 19% over FY 07. Two recent hires, Jonathan Link and Nahum Arav, received highly competitive and prestigious

awards: An Outstanding Junior Investigator Award from the DOE for Link and a major Hubble Space Telescope Award for Arav. Led by Bruce Vogelaar, a group comprising four universities (VT, Duke, NCSU, and UNC) proposed a \$16.6M Physics Frontier Center for “Neutrino Science and Technology”. While ultimately not successful, this effort demonstrates the increasing competitiveness of the department for such large center grants. Physics faculty members are listed as Co-PIs on both MRSEC proposals from Virginia Tech and on a \$6.3M MURI award from the Army Research Office. The Kimballton Underground Research Facility (KURF) now houses three experiments from four institutions, with four additional experiments being planned. As part of a developing focus on the commercialization potential of our research, several faculty members have begun to seek business or venture capital sponsorship for their projects in the materials physics and nanoscience arena. Overall, the faculty published 141 book chapters, refereed articles and refereed journal proceedings and gave 55 invited talks or lectures in over a dozen different countries in America, Europe, and Asia. The last number, in particular, demonstrates the completely global character of research in physics is an extremely international enterprise. Two patents were awarded.

Other initiatives also contribute towards increasing the visibility of the department. More so than in previous years, faculty members are organizing public lectures, workshops or conferences *here on campus*. This reporting period saw three such events: two public lectures and an international symposium. The two lectures were delivered by Joe Polchinski (KITP and UCSB), a member of the National Academy of Sciences, and Eva Silverstein (SLAC and (Stanford University), the winner of a McArthur genius grant. The symposium focused on *Complexity in Materials far from Equilibrium* and brought 12 invited speakers from the U.S. and Europe to Virginia Tech. Clearly, event introduced prominent invited speakers as well as participants from campus and elsewhere to the department, and disseminated our findings and programs far beyond the boundaries of Blacksburg. The faculty continue to engage in a variety of ways with the university and the broader community, including appearances in local and regional media, public lectures, and K-12 outreach. This year, our student-run Physics Outreach Team conducted 28 visits to local and regional schools, including the Northern Virginia Center.

This year, the department held several events for alumni and friends. The first event, “Fun with Physics”, was held at Virginia Tech’s Northern Virginia Center and attracted roughly 200 participants spanning all age groups. The second event took place in New Orleans, at the March Meeting of the American Physical Society. This is our main national conference covering many areas of physics and related fields. And as every year, our Physics Awards Ceremony celebrated the achievements of our students, together with parents, donors and friends of the department. New development activities saw the establishment of a major graduate scholarship as part of a will, and a pledge for a new undergraduate award – the “Bowden Prize” – which will reward an outstanding essay with a scientific theme. A highly successful business man, Mr. Mark Sowers, continues to support the department generously, as part of his fascination with fundamental theoretical physics.

Highlights of our activities are included in this report. Further details and relevant links may be found on <http://www.phys.vt.edu/>.

## Part 2: Academic Accomplishments

### I. Learning

#### Undergraduate Program

Our undergraduate program is characterized by its comprehensive course offerings, high expectations, and emphasis on individual student support and mentoring. Both faculty and staff are profoundly committed to these three foundations. Both the undergraduate and graduate coordinators are immensely dedicated to the success and the personal welfare of our students. They receive high praise from our current students and our alumni. Outside the class room, the faculty devote much time to student advising, either on course-related matters or through our flourishing undergraduate research program. Student groups such as the Society of Physics Students, the Astronomy Club, and the Ladies of Robeson provide emotional support and networking opportunities. Our student exit interviews highlight the breadth of our undergraduate research opportunities and the sense of community offered by the department as special strengths of the department.

Various curricular changes were implemented this year, to meet two goals: (1) to prepare our freshmen better for upper-level courses, and (2) to offer a suite of topical electives at the upper-level undergraduate and introductory graduate level. To address the first goal, a new course, Basic Tools of Physics, was added to the sophomore year, and two other courses were merged. The suite of topical electives consists, so far, of the following courses: Astrophysics, Biological Physics, Computational Physics, General Relativity, Nanotechnology, Optics, Solid State Physics, and Nuclear and Particle Physics. Many of these courses will be offered as conjoint 4000/5000 level courses, since they are also attractive to graduate students. Other topics of interest, e.g., Soft Materials, Networks and Complex Systems, Cosmology, String Theory, and a course focused on energy and sustainability, will be explored. Partnerships with other departments will support the development of these courses.



*Physics students at our "Back to School" Barbeque in August 2007*

Undergraduate research projects continue to be very popular with both faculty and students. Almost all of the faculty serve as mentors; 43 students are currently engaged in a wide variety of projects. As a result, our students are highly competitive for national awards. This year, junior Kevin Finelli won a Goldwater Scholarship. Viewed over all years, Physics has been tremendously successful in the competition for these prestigious awards: Our students have won 8 out of 37 Goldwater scholarships awarded to Virginia Tech). My Linh Pham (BS Physics and ECE 2007) is now a Physics graduate student at Harvard and won a highly competitive NSF Graduate Fellowship. Annalisa Pawlosky (BS Physics

2007), currently a graduate student at MIT, received an Honorable Mention in the same competition. In addition to research opportunities during regular term time, a variety of summer projects are being offered. In both Summer 2007 and 2008, roughly a dozen of our own students spend (part of) their summers in the department. We are also attracting increasing numbers of summer research interns from other institutions, including Norfolk State University, Cornell, and UC Boulder, and high school students from as far afield as Missouri. Out of seven interns, four are female and one is African-American. To give more visibility to our programs, the department submitted a proposal to NSF to establish an REU site at Virginia Tech. Even though the proposal was declined, it reviewed quite well and will be resubmitted this year.

The delivery of introductory physics courses, along with the associated laboratories, remains a key component of our teaching and learning mission. In AY 2007-08, the total enrollment in our calculus-based sequence (PHYS 2305-06) was 3123 students (mostly from the College of Engineering), and the enrollment in algebra-based course (PHYS 2205-06) stood at 1426 students, mostly from the life sciences. These numbers do not include summer enrollments (which would 100-200 students to these counts). Compared to the enrollment from the previous AY (again, not including summers), we are seeing increases of 15% and 7%, respectively. Clearly, these numbers and their growth place significant pressures on teaching staff, GTAs, and budgets. The department is making a major effort to retain an award-winning instructor, Dr. Roger Chang, by converting his position to a regular continuing appointment and sponsoring his green card petition. Our other superb instructor, Dr. Dan Mazilu, accepted a tenure-track faculty position at Washington and Lee University. His departure poses a major challenge for the coming year. The budgetary support for instructors and GTAs has been adequate but needs to be renegotiated year after year. A considerable challenge arises in the area of teaching lab equipment, supplies, and IT costs. In the past, state-allocated equipment trust funds (ETF) were used to upgrade or replace lab equipment; this year, a much narrower interpretation of ETF purchasing policies by the Controller's Office generated serious problems. If this narrow interpretation continues to be applied, it will become essentially impossible to use ETF funds for teaching lab upgrades. Other sources of funds have yet to be identified.

Our Astronomy program continues to be very popular with students from a broad range of backgrounds. The two-semester introductory sequence (which includes a lab) is taken by over 250 students per year. Astronomy remains a significant recruiting tool; conversations with incoming freshmen show that many of them are attracted to Virginia Tech by the astrophysics option. Until this year, staff shortages had curtailed our ability to develop this option, and especially the introductory sequence, to its fullest potential. Thanks to the enthusiasm of our new astronomer, Dr. Nahum Arav, a major overhaul of this sequence can now be undertaken, with the goal of attracting much larger student numbers to Astronomy. The department has allocated an experienced GTA to support to this venture.



*Award-winning students and parents at the Physics Awards Ceremony.*

As in previous years, the department celebrated its Awards Ceremony in the Spring, on April 4, 2008. Ten awards and/or scholarships were given to 31 undergraduates, and six awards were given to seven graduate students. In all, \$88,100 in funds was distributed. Parents, donors, and friends of the department were invited. After the luncheon and the recognition of the awardees, most of our guests attended the first Sowers Distinguished Lecture in Theoretical Physics, delivered by Prof. Joe Polchinski from the Kavli Institute of Theoretical Physics and the University of California at Santa

Barbara. By general agreement, the combination of luncheon and recognition, followed by a separate lecture, was an improvement over our previous structure (which consisted of a luncheon, followed by the combination of recognition and keynote).

### **Summary data:**

- The total number of physics majors is presently 123 (15 women, 1 minority), up 10% from last year (2006-07: 112 in all, 17 women).
- The number of physics minors stands at 7 (2006-07: 18).
- The number of astronomy minors is significant: 21 in total, including 8 females and one minority student (2006-07: 25 total).
- Over a third of our undergraduate students (43 at latest count) are involved in research projects with faculty in the department.
- Faculty in the department hosted seven summer research interns from other institutions: Cornell, University of Colorado at Boulder, Kenyon College, Norfolk State University, Washington and Lee, and a Missouri high school student. Four of these interns are female, one of them is African-American.
- Our graduating class of May 2008 consisted of 14 students (13 BS, 1 BA). Four students received Minors in Physics, and 5 received an Astronomy Minor.
- Six members of the Class of 2007 will be attending graduate school; one will enter the military; the remaining 7 will enter the work force or are still undecided.
- The graduating class of 2009 is expected to be quite large, at 25 students.
- Our current numbers for incoming new students are slightly lower than last year. For Fall 2008, 39 freshmen and 7 transfers have accepted admission to the Physics



*The Class of 2008*

Department; 7 of these are women, and 4 are minority students. Last year we had 48 new freshmen and 4 transfers.

- We continue to recruit very actively. Diane Walker-Green, our undergraduate coordinator, hosted several Physics Open House and Hokie Focus events, and visited 25 high schools and community colleges in the Northern Virginia, DC, and Richmond areas. Faculty and current students attend the on-campus recruiting events in large numbers and are always on hand to meet prospective students and their parents, even if they drop in unannounced.

### **Graduate Program**

Our graduate core curriculum in its current form remains unchanged. Its main purpose is to provide a solid foundation for more advanced study. However, various other changes were implemented or are in progress. In line with university and graduate school efforts to provide better feedback on progress towards degree, each student is interviewed annually by the Graduate Committee Chair, Dr. Uwe Täuber. In addition, faculty advisors are urged to provide constructive and detailed feedback in written annual progress reports. Finally, the number of years for which a student can hold a TA position has been limited to five. Faculty are strongly encouraged to find funding for additional RA positions and to mentor their students proactively in order to ensure satisfactory progress towards degree.

The graduate and the undergraduate electives are being aligned more closely. As described above, a suite of topical electives is now offered as conjoint 4000/5000 level courses. As a result, our graduate students now enjoy far more choices at the introductory level, and some faculty time is freed up. This time will be invested in teaching very advanced (6000 level) courses more frequently and with more variability. Recent 6000 level courses included Statistical Field Theory, Quantum Electronics (basically, a highly advanced course in nanoscience), Advanced Nuclear and Particle Physics, and Nonequilibrium Statistical Physics.

The quality of students in the graduate program is improving. Two are NSF Graduate Research Fellows; three others are NSF IGERT fellows; and one received a graduate fellowship from SURA/Jefferson Lab. Graduate student Juliette Mammei was awarded the Luise Meyer-Schutzmeister Memorial Award. This \$1000 award is presented annually to an outstanding woman graduate student in physics.

We continue to recruit aggressively, through an on-campus preview weekend, and by offering ICTAS and PhD 2010 scholarships to the most outstanding candidates. When we lose candidates to other institutions, the competition is stiff. This year, the two students who were offered ICTAS scholarships chose to attend UCLA and Harvard. A promising Chinese student has accepted our offer of a PhD 2010 scholarship, bringing the number of these scholarships in the department to two.

As in the past year, we held an on-campus recruitment event for prospective graduate students, on February 24, 2008. The date coincided with the campus-wide Graduate Preview Weekend, so that our visitors could avail themselves of the more general information provided by the Graduate School. Presentations outlining our research programs and degree requirements, poster sessions, lab tours, meetings with the major

research groups, and various opportunities for socializing with faculty and current graduate students rounded off the weekend. The event was also very useful for our current first-year graduate students who are deciding on their thesis topics and advisors.

As a way of highlighting our graduate program within Virginia Tech and beyond, we continue to place more emphasis on soliciting well-crafted nominations for graduate student awards. Several successful nominations ensued, as detailed below.

### **Summary data:**

- The total graduate enrollment in physics stands at 67 (9 women, 1 minority). This is an increase of 24% over last year (54, 11, 1). Over the past two years, our graduate enrollment has increased by a remarkable 46%.
- There are 57 students in the Ph.D. program (last year, 44).
- Two students received their Ph.D. Both have accepted tenure-track positions at small liberal arts colleges. Jiajia Dong will teach at Hamline College in Minneapolis-St. Paul, and Alexey Pronin will move to Central College, located close to Des Moines, Iowa. Four other PhD degrees will be completed over the coming summer.
- Seven students obtained the M.S. degree. Six of these students are continuing towards the PhD; one works at a major law firm in Northern Virginia.
- Our incoming class currently stands at 15 acceptances. Of these 15 students, three come from the U.S., and 12 are international. Six students are female, giving us an unprecedented number of incoming female students. We expect additional acceptances, especially from U.S. students, over the summer.
- 11 prospective graduate students attended our Graduate Preview Weekend. The event was well run, yet only one of our visitors will join us this coming fall.
- Two students hold PhD 2010 Fellowships; two students are EIGER IGERT Fellows and one is an ICTAS Fellow. Two students hold NSF Graduate Fellowships; one student is supported by a SURA award for graduate study.

## **II. Discovery**

The Department of Physics at Virginia Tech focuses on two broad areas: Condensed matter and materials physics on one hand, and particle and astrophysics, with a special focus in neutrinos, on the other hand. With 14 faculty members in the first group (and one impending retirement) and 12 in the second (and one imminent arrival), both groups are well balanced. Both groups comprise experimental and theoretical/computational research efforts.

Research thrusts in condensed matter and materials physics focus on nanoscale phenomena in various devices and materials as well as studies of complex systems and self-assembly near and far from thermal equilibrium. Naturally, this type of research lends itself easily



interdisciplinary collaborations, with faculty in the life sciences and engineering. The experimental condensed matter group explores a broad range of electronic, optical, and magnetic properties of nanoscale materials, including spin-dependent transport, ultrafast and nonlinear optics, self-assembly at the nanoscale, and organic/inorganic hybrid materials. Possible applications include biomedical imaging and microscopy, biosensors, electromechanical actuators, organic solar cells, and quantum computing. On the theoretical/computational side, our interests focus on the statistical physics of non-equilibrium phenomena and dynamic complex systems, including transport, correlations, and regulation in biological systems, aging in materials, and an understanding of the most fundamental aspects of far-from-equilibrium physics. This work has implications for materials science, disease control and drug development. At the nanoscale, the group employs density functional theory and band structure calculations to study the electronic, magnetic, and transport properties of various magnetic materials and nanostructures, with potential applications for high-storage media and portable neutron detectors.

Research efforts in particle and astrophysics typically involve large international collaborations at off-campus facilities all over the world, e.g., to Gran Sasso (Italy), Tsukuba (Japan), and Daya Bay (China), and even in space, e.g., the Hubble Space Telescope and the Chandra X-ray Observatory. These programs project an image of the department far beyond Blacksburg. Efforts in neutrino and nuclear physics probe the validity of the “Standard Model” of elementary particle physics and attempt to place constraints on different non-Standard Model scenarios. The discovery of neutrino oscillations, and hence non-zero neutrino masses, provided a first decisive deviation from standard model expectations. A better quantitative understanding of these oscillations forms one of the major activities of the particle physics group, through the study of solar neutrinos (Borexino, LENS), reactor neutrinos (Daya Bay), and neutrinos generated at accelerators (MiniBooNE). Computational and theoretical studies complement these experimental efforts. In the nuclear physics domain, various standard model tests are also underway, through precision tests of lepton universality (PIENU), parity violation in neutron decays (UCNA) and in electron-proton scattering (Qweak). In the high-energy sector, studies of charge-parity violation in neutral and charged  $B$  meson decays offer new insights into the dominance of matter over antimatter in our universe (Belle). At the most fundamental level, the theorists in this group explore the consequences of string theory for strong interaction physics and quantum chromodynamics, quantum gravity, and cosmology. Last but not least, the astronomy group focuses on transient phenomena at radio wavelengths, including possible signatures of exploding primordial black holes, and on quasar outflows which provide insights into the structure and dynamics of super massive black holes which are conjectured to form the center of these active galaxies. Other projects include studies of the interstellar medium and of specific astronomical



*View of the audience during the First Sowers Lecture*



objects (“warm absorbers”) in Seyfert galaxies.

**Summary data:**

- Research Highlights:

- The Borexino Solar Neutrino Experiment announced its first results on August 20, 2007. The collaboration reported a direct measurement of the Be7 solar neutrino signal rate performed with the Borexino low background liquid scintillator detector. This is the first real-time spectral measurement of sub-MeV solar neutrinos. Physics faculty members Raju Raghavan and Bruce Vogelaar, postdoc Christian Grieb, and graduate students Matt Joyce and Steve Hardy are co-authors on the paper announcing this key result.
- A paper on exploding primordial black holes, authored by faculty member John Simonetti and graduate students Mike Kavic and Sean Cutchin, along with two colleagues from the Virginia Tech ECE Department, Ellingson and Patterson, received considerable attention. In their paper, the authors propose that such an explosion could provide an observable signature for the presence of an extra dimension. At the moment, the only alternative method for detecting such extra dimensions involves the Large Hadron Collider at CERN in Geneva. This work was featured in the online news sections of the journals *Nature* (February 1, 2008) and *New Scientist* (February 5, 2008). It was also profiled on the Virginia Tech News (March 17, 2008).
- On March 20, 2008, the Belle Collaboration, including faculty member Leo Piilonen, postdoc Yosuke Yusa, and graduate students Manmohan Dash and Debrapatra Mohapatra, published a paper in the journal *Nature* in which they reported a striking difference in the direct CP-asymmetry between charged and neutral *B* meson decays. This results bears directly on the observed asymmetry between matter and antimatter in the universe.
- In a preprint posted on February 28, 2008, faculty members Jean Heremans and Djordje Minic proposed a new correlated state of matter which they called a spin dual of the fractional quantum Hall effect (SDFQHE). Given the right experimental and materials conditions of spin-orbit interaction, spin-spin interactions and electric fields, the new state may be observable.
- Faculty member Raju Raghavan was awarded US Patent # 7,332,627 “Compositions comprising Solvated Metals”.
- Faculty member Randy Heflin, together with his collaborators Z. Wang and S. Ramachandran, was awarded U.S. Patent #7,336,861 “Fiber Optic Sensor or Modulator Using Tuning of Long Period Gratings with Self-Assembled Layers.”
- Faculty member Nahum Arav and his research scientist Manuel Bautista were awarded two significant grants (a total of close to \$230,000) for their work involving the Hubble Space Telescope (HST) proposals approved. Arav will measure the chemical abundances around black holes situated about a billion light years away from us, and Bautista will create spectral models of singly-ionized iron-

- peak species. The prestigious HST program is very competitive, with a success rate of about 14%.
- Assistant Professor Jonathan Link was awarded a highly prestigious “Outstanding Junior Investigator Award” from the DOE, to pursue his studies of neutrino oscillations at the Chinese Daya Bay Reactor Facility. Only ten of these awards were made nation-wide.
  - Led by faculty member Bruce Vogelaar, a group comprising four universities (VT, Duke, NCSU, and UNC) proposed a \$16.6M Physics Frontier Center for “Neutrino Science and Technology”. While ultimately not successful, this effort demonstrates the increasing competitiveness of the department for such large center grants and strengthens the interactions between researchers at these universities, building tremendous regional strength in neutrino physics.
  - The Kimballton Underground Research Facility (KURF) now houses three experiments, involving five institutions: Duke, NCSU, NIST, UNC and Virginia Tech. Four additional experiments, led by Princeton, Fermilab, Virginia Tech, and the University of Maryland, are in the planning stages.
  - Various faculty members are exploring the commercialization potential of their research, through seeking business or venture capital sponsorship. Projects include novel materials for energy storage and new non-invasive biomedical imaging techniques.
  - Publications:
    - Since publications are by calendar year, it is nontrivial to provide a precise count of those published in a fiscal year. Thus, 141 journal-articles/book-chapters/invited-proceedings were published in 2007. An estimated xx more were published in the first few weeks of 2008.
    - “Ageing and the Glass Transition”, edited by Dr. Michel Pleimling, in collaboration with Malte Henkel and Roland Sanctuary, was published by Springer as Volume 716 of the *Lecture Notes in Physics* series.
    - Undergraduate students appear frequently as co-authors on papers. A few examples are (student name in bold):
      - **D. A. Adams**, R.K.P. Zia, and B. Schmittmann, *Power spectra of the total occupancy in the totally asymmetric simple exclusion process*. Phys. Rev. Lett. **99**, 020601 (2007).
      - **C. D. Knorowski**, J.A. Anderson, and A. Travesset, *Self-assembled ordered polymer nanocomposites directed by attractive particles*, J. Chem. Phys. 128, 164903 (2008).
      - G.A. Khodaparast, R.N. Kini, K. Nontapot, M. Frazier, **E.C. Wade**, J.J. Heremans, S.J. Chung, N. Goel, M.B. Santos, T. Wojtowicz, X. Liu, and J.K. Furdyna, *Control and Probe of Carrier and Spin Relaxations in InSb-Based Structures*. Springer Proc. Phys. Series, 13<sup>th</sup> Intern. Conf. of NGS (2008).
  - Selected invited talks at national/international conferences/workshops/schools:

- Dr. Minic: *Miami Annual Conference on Fundamental Physics*, Fort Lauderdale; *University of Edinburgh workshop “Thermodynamics of space-time”* Edinburgh, Scotland.
- Dr. Park: *Symposium of Theory of Clusters and Atoms*, Richmond, VA.
- Dr. Pleimling: *International Workshop on “Fluctuation and dissipation phenomena in driven systems far from equilibrium,”* Max-Planck Institut für Physik komplexer Systeme, Dresden, Germany.
- Dr. Raghavan: *TAUP07 International Conference*, Sendai, Japan.
- Dr. Schmittmann: *International Workshop on “Fluctuation and dissipation phenomena in driven systems far from equilibrium,”* Max-Planck Institut für Physik komplexer Systeme, Dresden, Germany; *98th Statistical Mechanics Conference*, Rutgers University, NJ.
- Dr. Täuber: *97th Statistical Mechanics Conference*, Rutgers University, NJ.
- Dr. Zia: *Workshop on “Statistical Physics Out of Equilibrium,”* Institut Henri Poincaré, Centre Emile Borel, Paris, France.
- Conferences, workshops, and distinguished lectures at Virginia Tech:
  - The Physics Department, supported by the Sowers Fund, the College of Science, the Research Division, and NSF, hosted an International Symposium, on “Complexity in Materials far from Equilibrium”, on May 14-16, 2008. 24 speakers from different institutions across the US, Canada, Denmark, France, Germany, and Korea discussed dynamical phenomena in glasses, colloids, granular matter, superconductors, and biological systems.
  - Prof. Joe Polchinski, from the Kavli Institute of Theoretical Physics and the University of California at Santa Barbara, presented the first Sowers Distinguished Lecture: “Beyond Einstein: String Theory and the Puzzles of Quantum Gravity” (April 4, 2008).
  - Prof. Eva Silverstein (Stanford University & SLAC) visited the department, co-sponsored by the AdvanceVT Distinguished Lectures Program. She spoke about “Light from the Early Universe and Quantum effects in Gravity” (April 25, 2008).
- At present, there are 10 postdoctoral research personnel working with faculty in the department. They have a significant effect on our research productivity and form an essential component of every start-up package.



*Joe Polchinski and Eva Silverstein, during the “Question and Answer” period after their lectures.*

### III. Engagement

Members of the physics department are engaged in a multitude of activities, reaching far beyond the boundaries of the department. Within the university, physics is a key player in the nanoscience and materials arena, through linkages within the College of Science, ICTAS and the College of Engineering. Physics is also becoming a frequently consulted partner for faculty searches across the university, in the areas of quantitative biology and self-assembly in soft materials.

It is equally essential to reach out beyond the campus community, through a variety of events, activities and newsletters. Relations with alumni, donors and friends of the department, major corporations, regional schools, and the media need attention and nurturing. Within their professional communities, faculty referee extensively for journals and funding agencies. Several of them have organized conferences and hold leadership positions in their professional organizations.

At a more educational level, our student-run outreach program, which brings physics to K-12 in local schools, continues to thrive. Participating undergraduates usually return to their studies with more enthusiasm and motivation. As part of our recruitment efforts, high school students and undergraduates from other institutions participate increasingly in summer research opportunities within the department.

This year saw two events for alumni and friends. Combining recruiting, outreach, and alumni relations, a group of faculty and the Physics Outreach Team organized a Sunday afternoon of “Fun With Physics” at Virginia Tech’s Northern Virginia Center on February 10, 2008. The event drew about 200 people of all ages, even though both Hillary Clinton and Barack Obama were holding rallies in the vicinity. The Physics Outreach Team presented dozens of hands-on physics demonstrations and toys, and Prof. John Simonetti introduced the audience to “Life in the Universe”. An informal reception rounded out the afternoon. The event was highlighted in the NVC Online News on March 14, 2008.



*The next generation is having “Fun with Physics”.*

A small reunion took place at the March Meeting of the American Physical Society, the premier US physics conference. About 20 alumni, current “Hokies” and friends gathered in an informal New Orleans restaurant.

In the area of development, Mr. Mark Sowers continues to be engaged with the department, through donations to support fundamental theory and through the exploration of intellectual property. New activities saw the establishment of a major graduate scholarship as part of a

will, and a pledge for a new undergraduate award – the “Bowden Prize” – which will reward an outstanding essay with a scientific theme.

Some other highlights of our activities are listed below:

- The Physics Outreach Team organized 28 visits to local and regional K-12 classes/student groups and gave informative and entertaining physics presentations with hands-on demonstrations. This program is now coordinated by Josh Peebles, a permanent staff member and alumnus of our department.
- On October 20, 2007, the Society of Physics Students (SPS) Chapter at Virginia Tech hosted the 2007 SPS Zone 4 Meeting.
- Two important annual events are the Awards Ceremony (April 4, 2008) and Commencement (May 10, 2008). These celebrations highlight the department to family members and friends of our students, as well as donors and alumni.
- “Fun With Physics”, an event for alumni and friends, drew a crowd of all ages at Virginia Tech’s Northern Virginia Center. The Physics Outreach Team presented dozens of hands-on physics demonstrations and toys, and Prof. John Simonetti discussed “Life in the Universe” (February 10, 2008). The event was also highlighted on the NVC Online News on March 14, 2008.
- The Physics Department hosted an Alumni Reunion at the APS March Meeting in New Orleans, LA (March 11, 2008).
- Research projects by physics faculty was featured on various occasions in Virginia Tech’s media outlets:
  - The first direct measurement of solar neutrino fluxes, performed by the Borexino Collaboration which includes Profs. Vogelaar and Raghavan, was highlighted on the Virginia Tech News (September 3, 2007).
  - The Neutrino Group is profiled in an article entitled “Scientists at Virginia Tech explore the heart of the sun and other deep mysteries”. (Winter Edition of VT Research Magazine).
  - The group was highlighted on the Virginia Tech main page, under “Spotlight on Innovation: Everything under the Sun” (March 2008).
- Several faculty members were interviewed in the media:
  - Dr. Marvin Blecher shared his recollections of the Sputnik area in an interview by American Public Media for the Weekend America Program titled “Memories of Sputnik.” (October 6, 2007)
  - Dr. Jonathan Link described neutrinos as “Place Kickers” in a radio interview broadcast during the football game against Duke. (October 13, 2007)
  - Dr. John Simonetti was interviewed by the Roanoke Times on light pollution (September 24, 2007). He and undergraduate researcher Jessica Gorzo were also interviewed by the *Collegiate Times* regarding Comet Holmes (November 16, 2007).
- Physics faculty members presented numerous talks for general audiences:

- Dr. Nahum Arav gave a public lecture with the title “The Paranormal Universe.” It is followed by a spirited discussion of paranormal phenomena (March 26, 2008). A day before the talk, Prof. Arav was interviewed for the online magazine “Planet Blacksburg.”
- Dr. Randy Heflin presented a keynote “Nanotechnology: No Assembly Required” to about 100 high school students and their parents at the Virginia Tech “Explorations in Nanoscale Science and Engineering” workshop, sponsored by the Center for Talented Youth (November 11, 2007).
- Dr. Khodaparast presented monthly lectures on various topics in nanoscience to students at the Roanoke Valley Governors’s School.
- Dr. John Simonetti gave a Lunch Time talk to the Blacksburg – Montgomery County Kiwanis Club, on “Life in the Universe” (November 29, 2007)
- Dr. Vicki Soghomonian spoke to the Women in Philanthropy – Circle of Excellence group, “The molecular electronics of charge conductance through DNA” (June 2007, not yet reported).
- Dr. Royce Zia spoke about “What is Physics - A Personal Perspective” at the Graduate Life Center (February 15, 2008).
- The professional service activities of physics faculty members span a broad range:
  - Dr. Heflin served on the Program Committee for the CLEO/QELS Conference. He is an Editorial Board Member of the *International Journal of Nanoscience*.
  - Dr. Link served on the Institutional Board of the Daya Bay Collaboration. He is also the Chair of the Talks Committee of the MiniBooNE Collaboration, and a member of the Talks Committee of the Daya Bay Collaboration.
  - Dr. Pilonen serves the Belle Collaboration in different functions, e.g., through membership on its Executive Committee and its Institutional Board.
  - Dr. Pitt is an elected member of the Executive Committees of two leading experiments at Jefferson National Laboratories, G0 and Qweak.
  - Dr. Pleimling served as reviewer and panelist for the European Commission’s prestigious Marie Curie Fellowship program.
  - Dr. Raghavan was a member of the International Advisory Committee on Antineutrino Science, Paris (France).
  - Dr. Schmittmann serves as Vice-Chair of the Group for Statistical and Nonlinear Physics of the American Physical Society (APS). She is an Editorial Board Member for *Physical Review E* and the *American Journal of Physics*.
  - Dr. Täuber is a member of the Editorial Board of the electronic journal *Research Letters in Physics*, and an Advisory Panel member for the *Journal of Physics A*.
- A few highlights of university service are provided below:
  - Dr. Blecher serves on the Personnel Committee, College of Science.
  - Dr. Heflin serves on the ICTAS Sustainable Energy Group Steering Committee.
  - Dr. Heremans serves on the ICTAS Faculty Advisory Board and the MicrON Group Executive Committee.



- Dr. Khodaparast serves on the Executive (“Core”, “Cluster”) Search Committee, College of Science.
- Dr. Piilonen chairs the College of Science Curriculum Committee.
- Dr. Robinson served on the MicrON Cleanroom Executive Committee.
- Dr. Täuber serves on the Investigative Board and the Judicial Panel for the Graduate Honors System.
- Dr. Zia is a member of the Advisory Boards of *AdvanceVT* and EIGER (*Exploring Interfaces through Graduate Education and Research*, an NSF-IGERT grant administered through the department of Geological Sciences).
- Departmental service remains an important component of our activities:
  - Faculty members serve on one or more departmental committees. Departmental committees include standing committees: the Executive Committee, Faculty Evaluations Committee, Graduate Committee, Graduate Recruitment Committee, Undergraduate Committee, Undergraduate Committee, Shop and Safety Committee, Colloquium Committee, and the Seminar Committee. In addition, there are ad-hoc committees: Outreach (K-12) Committee, Undergraduate Research Committee, Cluster Hire Search/Screening Committee, Computational Facilities Committee and the Department Review Committee.
  - Faculty members also serve in other capacities, individually: Astronomy Club Advisor (Dr. Simonetti), Demonstrations Supervisor (Dr. Pitt), Diversity Contact (Dr. Park), Martin Observatory Coordinator (Dr. Simonetti), Lab coordinator for ChemPhys Building (Dr. Pitt), Prices Fork Observatory Coordinator (Dr. Simonetti), Society of Physics Students Advisor (Dr. Soghomonian), Sigma Pi Sigma Advisor (Dr. Pitt), Webmaster (Dr. Takeuchi, with assistance from Ms. Betty Wilkins).
- Concluding with a very different version of engagement, members of the department or their spouses gave birth to six babies. Dr. Marvin Blecher welcomed his first grand daughter, Dara, to the world.



*Marvin and Dara*

## IV. Diversity Activities

Bucking national trends, women are better represented at the more advanced levels in the department. Four out of 26 faculty members, i.e., 15%, are female, which is much higher than the national average of 10% for physics departments in Ph.D. granting institutions. Including the incoming students for the fall, 18% of our graduate student population are female, which is essentially indistinguishable from the national average of 19%. At the undergraduate level, again including the incoming students, women make up 15% of our student body. That number is quite disconcerting, since it is *much lower* than national figures (for example, nationally, women earn 21% of bachelor's degrees in physics). Tracking these trends, we find that many of the outstanding female applicants choose other institutions over Virginia Tech. We may need to consider stronger recruitment incentives if we wish to compete in this market.

The “Ladies of Robeson”, a networking group consisting of all women in the department (faculty, students, and staff) continues to flourish. This year saw several dinner parties, a trip to the local ice rink, and movie nights with pizza. In our exit interviews, the “Ladies of Robeson” group is mentioned frequently as a source of support and information, regarding course work, research opportunities, and preparation for graduate school.

Female students tend to be very active in undergraduate research, as the summary data at the end of this report show. It is also encouraging that we attract a significant fraction of female interns from other universities and high schools for summer projects (four out of seven).

Minorities are sorely underrepresented in physics. Hispanic-Americans earn 4% of BS degrees in physics, and African-American earn 3%. Translated into our numbers, we should graduate about one minority student per year. Clearly, all counts in this regard are subject to large fluctuations. However, minorities are underrepresented in the department (1 out 123 majors). We are seeking to remedy this situation by (1) being more present in the Northern Virginia/Richmond areas where schools are more diverse; (2) mentoring our minority undergraduates towards successful completion of undergraduate and advanced degrees, through participation in the McNair or MAOP programs; (3) attracting summer interns from HBCUs such as Norfolk State who can serve as liaisons for further contacts.

Some other highlights of our activities are listed below:

- Dr. Nahum Arav attracted an outstanding Hispanic scientist, Dr. Manuel Bautista, into his group. In May, Arav and Bautista were awarded \$250K of funding to support their research involving the Hubble Space Telescope.
- Dr. Pitt successfully nominated his graduate student Juliette Mammei for a Luise Meyer-Schutzmeister Memorial Award which is presented annually to an outstanding woman graduate student in physics.

- Dr. Soghomonian served as Chair of the AdvanceVT Visiting Scholars Committee, until August 2007.
- Dr. Schmittmann continues her work on behalf of the Virginia Tech *AdvanceVT* program. She serves as Co-PI on this NSF award (\$3.5M for 5 years).
- Our summer research internships attract women and minorities. Dr. Arav hosted two female students from Cornell and UC Boulder; Dr. Khodaparast hosted a female high school student from Missouri and an African-American female from Norfolk State; Dr. Schmittmann mentors a McNair Scholar.
- The Department and AdvanceVT co-hosted Prof. Eva Silverstein (Stanford University & SLAC) as an AdvanceVT Distinguished Speaker.
- Drs. Simonetti and Takeuchi play lead roles in the *Phoebe's Field* project. Led by Mitzi Vernon from the Industrial Design department in CAUS, an interdisciplinary team of designers, engineers and physicists is developing a traveling exhibition, illustrating the concept of physical fields for elementary and middle school children, especially girls.
- Dr. Takeuchi visited Ochanomizu Women's University in Tokyo during the summer to educate and recruit gifted female students. He also acts as English advisor there.

## V. Honors and Awards

At all levels, members of the physics department have been honored in a multitude of ways. Following are the highlights.

### Faculty

- Dr. T.S. "Roger" Chang received the 2008 Faculty Appreciation Day Students' Choice Award for Faculty Member of the Year.
- Dr. Jonathan Link received a highly prestigious Outstanding Junior Investigator Award from the US Department of Energy. Only 10 of these prestigious grants were awarded in a nation-wide competition (May 5, 2008). He is part of the MiniBooNE collaboration whose most recent results were selected by the American Institute of Physics as one of the top ten physics stories of 2007.
- Drs. Michel Pleimling and Tatsu Takeuchi were honored at the Virginia Tech Authors Day 2008.
- Dr. Beate Schmittmann received an "Advancing Women at Virginia Tech Award".
- Dr. Uwe Täuber was recognized as "Outstanding Referee" by the American Physical Society.
- Three professors were honored as Virginia Tech Scholar of the Week:
  - Dr. Giti Khodaparast, November 26, 2007
  - Dr. Royce Zia, January 1, 2008
  - Dr. Indebetouw, April 21, 2008

## Staff

- Computer Technician Travis Heath was recognized for 10 years of service.
- Graduate Program Coordinator Chris Thomas was honored as a nominee for the President's Award for Excellence.

## Graduate Students

- Juliette Mammei was awarded the Luise Meyer-Schutzmeister Memorial Award. This \$1000 award is presented annually to an outstanding woman graduate student in physics.
- Mike Kavic was awarded the Best Student Presentation Prize at the 11th Eastern Gravity Meeting, held at the Institute for Gravitation and the Cosmos at Penn State. The award is sponsored by the APS Topical Group on Gravity.
- An essay by Mike Kavic, Djordje Minic and John Simonetti received an honorable mention in the 2008 Gravity Research Foundation Essay Competition.
- Dr. Heflin's graduate student Manpreet Kaur was one of six Virginia Tech graduate students selected to represent the university at the Graduate Research Forum with the Virginia General Assembly in Richmond (February 2008).
- Two other graduate students from Heflin's group were awarded 1st and 3rd places in the Optical Society of America Student Chapter Poster Competition.
- Two graduate students were recognized by the Graduate School as *Featured Graduate Student of the Month*: Kanokwan Nontapot (Advisor: G. Khodaparast) in November 2007, and Jiajia Dong (Advisors: R.K.P. Zia and B. Schmittmann) in December 2007.
- Seven graduate students were inducted into Sigma Pi Sigma, a national honor society for Physics Students, at a banquet attended by faculty, staff, parents, and family members. Dr. Simonetti discussed "What is it all about?"
- Six departmental awards/scholarships were presented to seven graduate students.



*Juliette Mammei*



*Kanokwan with her husband and one of their two cats*

## Undergraduate Students

- Physics junior Kevin Finelli was awarded a Goldwater Scholarship. Kevin is the 8<sup>th</sup> winner from Physics, out of 37 Goldwater Scholarships for Virginia Tech since the program began in 1986.
- My Linh Pham (BS Physics and ECE 2007), currently a graduate student in Physics at Harvard, received an NSF Graduate Research Fellowship, one of out of 45 awarded nation-wide in Physics. These prestigious fellowships are awarded on the basis of a

national competition, including a detailed research proposal. Annalisa Pawlosky (BS Physics 2007), currently a graduate student at MIT, received an Honorable Mention. Max Lavrentovich, a summer intern with Royce Zia, also received an Honorable Mention. Max was offered an ICTAS Fellowship for graduate study at Virginia Tech but turned us down in favor of Harvard.

- Charles Baker received the College of Science Rising Sophomore Award.
- Junior Ashley Tabb was honored with a Barbara Lotze Scholarship for Future Teachers, awarded by the American Association of Physics Teachers.
- Ten departmental awards/scholarships were presented to 31 undergraduate students.
- 13 undergraduates were inducted into Sigma Pi Sigma, a national honor society for Physics Students.
- 32 Physics majors made the Fall 2007 Dean's List.
- Pam Granger (BS Physics 2004) and Mary Ellen (Tremblay) Bowman (BS Physics) passed their bar exams in Fall 2007.

## **VI. Future directions**

As science becomes increasingly interdisciplinary, physics needs to define itself within a much broader framework than before. Today, the solutions to critical research problems are rarely discovered within the confines of a single discipline. An open mind for the problems arising in other sciences and an ability to “speak their languages” will increasingly determine the success of individuals and disciplines. For the foreseeable future, a careful balance must be struck between discipline-specific research (which always offers the opportunity of major breakthroughs and unexpected spinoffs) and intentionally interdisciplinary collaborations.

The department is undergoing a significant generational change. Seven faculty members are near the traditional retirement age. The impending transition poses major challenges, in terms of faculty hires, competitive start-up packages, and high-quality research space. These challenges will need to be managed carefully to avoid placing heavy burdens (of teaching or service) on younger faculty which might impact their research productivity.

Considering its research directions, some of the major opportunities for the department can be found in materials physics, biological physics, and complex systems, where the Virginia Tech environment offers rich opportunities for collaborations. ICTAS is becoming more receptive to developing enhanced materials synthesis and fabrication capabilities which would provide a huge boost to innovative materials research in the department and the university. Samples can be grown in-house, providing flexibility, responsiveness, and hence opportunities for scientific leadership, through the development of *unique* materials which can form the central scientific core of a MRSEC or MURI proposal. Multifunctional materials – controllable through a variety of “knobs” (optical, electrical, magnetic, and mechanical means, etc.) – attract growing interest, and the department has considerable strength in this area.

The quantitative study of biological systems, using physical tools or techniques, is likely to remain a very active field for the foreseeable future. An understanding of non-equilibrium phenomena and their role in regulatory processes, the development of new imaging techniques, and the design of novel biocompatible functionalized materials, are three areas in which the department can play key roles.

Complex systems and specifically networks are becoming a topic of growing interest at Virginia Tech. Networks – i.e., dynamic webs of interacting agents – are at the core of many biological, engineering, and social processes, structures, and problems. Biological networks include ecological networks such as food webs, regulatory networks in the cell, and complex social and symptomatic networks in “diseases” such as obesity. Physical networks include transportation infrastructures, water systems and communication and power grids. Social networks range from social networking sites like MySpace to the unstructured hierarchies and interactions of terrorist cells. Clearly, researchers in one area have much to learn from the knowledge of their peers in another – and physicists are experts in building analytic and modeling tools which focus on the common, “universal” features shared by these seemingly diverse problems.

Opportunities abound in the particle and astrophysics area as well. With a new faculty member in astrophysics and the recent attention directed at exploding primordial black holes, the astronomy group is developing new strengths. Astronomy and astrophysics capture the mind of the public in ways that few other science fields do, and offer enormously rich research problems. As large-scale particle accelerators become prohibitively expensive, physics is looking ever deeper into space, to explore exotic matter and to probe the very fabric of space and time. Particle physics and astrophysics merge here. Observational astronomers, antenna and wireless engineers, neutrino physicists, detector experts and string theorists can find common ground here and create a completely new synergy. Our small yet distinguished particle and string theory group can provide creative guidance to these efforts.

The neutrino group will acquire new energy and new expertise when Dr. Patrick Huber arrives in August. As a theorist who models proposed experiments and places constraints on the expected findings, he is highly regarded as a valuable partner by many experimental groups around the world. The group as a whole is strengthening its portfolio, thanks to the growing reactor neutrino component led by faculty members Link and Piilonen. For the MiniLENS and LENS projects, the Kimballton facility presents a unique resource which has also been discovered by others. Developing its full potential remains an important and essential task.

In the area of energy-related research, various seeds are emerging. Heflin’s research on organic photovoltaic materials contributes to the development of novel, non-silicon based solar cells. In addition, Soghomonian may be approaching a breakthrough in the development of new materials for energy storage. And third, an initiative is emerging, led by Vogelaar, to develop a new nuclear reactor design, fueled by unenriched Uranium. If successful, this design would solve many serious problems, such as proliferation of weapons-grade fuel and waste disposal. Since these three efforts are very diverse and partly in their early stages, they deserve nurturing and support. Other opportunities in energy-related research will be explored over the coming year.



Pursuing large scale funding opportunities, especially in leading roles, will be a high priority for the department. To be competitive for a Materials Research in Science and Engineering Center (MRSEC) or a Physics Frontier Center (PFC), a unique research portfolio is necessary to provide a firm foundation. Yet, a number of other building blocks should also be in place: outstanding faculty with strong funding records; accomplishments in student training (through successful REU and IGERT grants); strong university support, in terms of research space and large-scale shared experimental facilities (materials synthesis and growth capabilities would be critical here, at least for materials research), and good K-12 outreach programs and diversity efforts. Other factors, such as corporate connections, partnerships with other universities or national labs, and international outreach, will also come into play. It will be essential to keep these fundamentals in mind.

In the area of teaching and learning, growing enrollments in our service courses place serious burdens on our resources. With ETF funds becoming increasingly constrained, it is conceivable that teaching lab upgrades will have to be covered from other sources. In that case, lab fees will become unavoidable.

Our undergraduate program remains vibrant, and the faculty take great pride in the achievements of our students. Similarly, the students report great satisfaction with the academic quality of their degree program and with the personal mentoring that they have received in the department. Their preparation for the top graduate schools in the country is outstanding. At the same time, the department could provide more varied advice and information for those students headed towards non-academic careers. Many of our recent alumni have chosen to join large corporations or start-up companies, and an event which will bring some of them back to campus is already in the planning stages. We have contacts at Pfizer, Google, IP law, Wall Street, in renewable energy, and the government sector.

With regard to student recruitment and community outreach, we plan repeats of the Northern Virginia "Fun with Physics" event. One event will be held in Northern Virginia, and a second event will take us to the Richmond area. The Graduate Preview Weekend will also continue. An alumni gathering at the APS March Meeting will form part of our standard program this year.

Courses will be continually monitored, streamlined, and infused with the latest scientific discoveries, both at the undergraduate and the graduate level. We will resubmit our REU proposal from last year and continue to explore different avenues which may result in additional graduate teaching and research assistantships for the department. One essential avenue is to increase development activities. Fortunately, a number of faculty members are aware of the importance of this activity and are beginning to participate. The targeted areas are scholarships for graduate students, departmental postdoctoral fellowships, endowed chairs for junior faculty, support for a distinguished lecture series and/or symposia and workshops, as well as funding for research activities in general.

Finally, Physics is scheduled to undergo a departmental review in September 2008. Intense discussions and data collection efforts are underway. Since the last review occurred over ten years ago, this activity is long overdue. Indeed, the face of the department has changed beyond recognition since then. So has the environment in which it finds itself, from the local academic to the wider global setting. With the help of the review, the department will position itself strategically to take full advantage of swiftly evolving boundary conditions.

## Part 3: Additional Information

### Grants received:

Externally funded grants since July 1, 2007 (From OSP Dashboard):

Fund Code	Grant Short Name	Investigator Full Name	% Credit	Award Amt	Comments
415859	Physical conditions in the best obs	Arav, Nahum	1.	\$108,500	
426624	Support of NASA office of chief eng	Giovane, Frank	1.	\$49,999	
426636	Support of fiber optic micrometeoro	Giovane, Frank	1.	\$39,098	
477756	Development of a low-energy neutrin	Grieb, Christian E.	0.2	\$22,458	
477757	Development of a low-energy neutrin	Grieb, Christian E.	0.2	\$1,542	
477489	A summer research experience for un	Heflin, James R.	0.25	\$22,500	
430200	Multilayered technologies for armor	Heflin, James R.	0.14	\$68,114	
430316	Multilayered technologies for armor	Heflin, James R.	0.14	\$68,845	
477515	Mems-based multicapillary columns w	Heflin, James R.	0.33	\$26,392	
430274	Development silica fibers and micro	Heflin, James R.	0.35	\$28,013	
430275	Development silica fibers and micro	Heflin, James R.	0.35	\$1,750	
430276	Development silica fibers and micro	Heflin, James R.	0.35	\$22,737	
415634	Long-period grating Ph Sensor- TSWG	Heflin, James R.	1.	\$75,000	
430286	Ionic liquids in electroactive devi	Heflin, James R.	0.3	\$341,627	
430287	Ionic liquids in electroactive devi	Heflin, James R.	0.3	\$35,621	
430288	Ionic liquids in electroactive devi	Heflin, James R.	0.3	\$32,010	
430289	Ionic liquids in electroactive devi	Heflin, James R.	0.3	\$16,993	
477639	Carrier and spin dynamics in insb -	Khodaparast, Giti	1.	\$7,000	REU associated with 477365
477365	Carrier and spin dynamics in insb -	Khodaparast, Giti	1.		on NCE
430251	Probing and manipulation of coheren	Khodaparast, Giti	1.	\$109,944	
477345	Strange form factors and a low ener	Morgan, Norman K.	0.25	\$23,500	
443010	Computational study of magnetic pro	Park, Kyungwha	1.	\$10,000	
429151	Study of electroweak interactions	Piilonen, Leo E.	1.	\$299,500	
477345	Strange form factors and a low ener	Pitt, Mark L.	0.75	\$70,500	
477715	Transport of polarized ultra cold n	Pitt, Mark L.	0.2	\$23,041	
477901	Complexity in materials far from eq	Pleimling, Michel J.	0.5	\$2,600	
477355	Neutrino physics: Borexino & Lens	Raghavan, Ramaswamy	0.3	\$108,000	
477756	Development of a low-energy neutrin	Raghavan, Ramaswamy	0.8	\$89,831	
477757	Development of a low-energy neutrin	Raghavan, Ramaswamy	0.8	\$6,169	
477905	Ultra-Efficient Plasmonic nanoparti	Robinson, Hans	0.5	\$15,705	
477914	Ultra-Efficient Plasmonic nanoparti	Robinson, Hans	0.5	\$7,955	
477918	Ultra-Efficient Plasmonic nanoparti	Robinson, Hans	0.5	\$1,493	
477012	Advanced institutional transformati	Schmittmann, Beate	0.25	\$179,065	
477341	IGERT: Eiger- exploring interfaces	Schmittmann, Beate	0.	\$0	Core faculty
477700	Statistical mechanics of systems fa	Schmittmann, Beate	0.5	\$0	\$95K for FY08 awarded FY 07
477699	collaborative research: chromatic h	Sharpe, Eric R.	1.	\$27,017	
429190	Invest In Dynamics Of Gauge Theorie	Takeuchi, Tatsu	0.5	\$62,250	
477901	Complexity in materials far from eq	Tauber, Uwe C.	0.5	\$2,600	
477355	Neutrino physics: Borexino & Lens	Vogelaar, Robert B.	0.7	\$252,000	
477715	Transport of polarized ultra cold n	Vogelaar, Robert B.	0.8	\$92,165	
477700	Statistical mechanics of systems fa	Zia, Royce K P.	0.5	\$0	\$95K for FY08 awarded FY 07
<b>Total</b>	<b>Total</b>	<b>Total</b>	<b>Total</b>	<b>\$2,351,532</b>	

To summarize, the total amount of funding per year, administered by PIs and Co-PIs from the Physics Department, comes to approximately \$2.35M.

In addition, faculty members from physics receive funding from other sources which are not captured by the OSP Dashboard.

- Drs. Kulkarni and Schmittmann are part of the EIGER project. Administered in Geosciences, this IGERT grant supports two graduate students in physics, including their stipend, tuition, travel and support costs (~\$100K/student).
- Drs. Heremans, Indebetouw, Kulkarni, Ritter, Robinson, and Soghomonian received seed grants from ICTAS.

In total, this translates into research funding for the department of approximately \$2.65M.

### **New Faculty**

- Dr. Eric Sharpe, Assistant Professor (August 2007)
- Dr. Nahum Arav, Associate Professor (January 2008)
- Dr. Roger Chang, converted from restricted to regular instructor
- Dr. Manuel Bautista, research scientist, and four postdoctoral associates.

### **Faculty Promotions and Retirements**

- Dr. Guy Indebetouw will retire effective August 9, 2008 (official date: 9/1/2008).
- No promotions occurred this year.

### **Staff Hires, Promotions, and Retirements**

- New Business Manager: Mary Ferraro (September 2007)
- New Fiscal Technician: Tina Lawrence (December 2007)
- New Program Support Technician: Tammy Harris (February 2008)

Some fiscal and other administrative duties were redistributed amongst Harris, Lawrence and Wilkins.

### **Undergraduate Research**

- Partial list of undergraduate students involved in research in Physics:

Melvin Amos, Richard Bailey, Daniel Baker, Anna Belak, Elizabeth Bonnell, Kristen Brown, Aaron Burger, Jonathan Cates, W. Duvall, Kevin Finelly,

Daniel Flisek, Will Frey, Vojtech Gall, Jessica Gorzo, Matt Grote, Brandon Harp, John Hoffman, Jonathan Hughes, Chris Knorowski, Elizabeth Lowry, Nicholas Luhning, Julian McMorrow, Jo Ellen Narron, Brandon Nipper, Emalee Popoff, Richard Samulski, Jennifer Stapor, Stuart Strommen, Paul Trampart, Emily Wade.

- Some details (further links on <http://www.phys.vt.edu/undergradresearch.html>):
  - Anna Belak and Richard Samulski worked on the synthesis and AFM imaging of DNA assemblies on various surfaces, supervised by Dr. Soghomonian.
  - Jo Ellen Narron, Chris Knorowski, Nick Luhning and Paul Trampart are developing detector components for the Daya Bay experiment with Dr. Link.
  - Jessica Gorzo is running density-functional theory calculations for small molecules, in the research group of Dr. Park. Jessica is also writing code and analyzing data for the ETA telescope array, with Dr. Simonetti.
  - Kevin Finelli is working with Mark Pitt on hardware and software projects for the Qweak collaboration.
  - W. Duvall, Aaron Burger, Will Frey and Matt Grote are working with Hans Robinson on the fabrication of metallic nanostructures for surface plasmon enhancement of non-linear optical effects in polymer films.
  - John Hoffman is working with Royce Zia on novel phases in simple models for traffic on two lanes.