2010-2011 Annual Report

Department: __Physics_____

Learning: Undergraduate

Faculty and departmental teaching awards (incl. college, university and national awards); student recognitions:

- **Prof. Leo Piilonen receives 2011 William E. Wine Award** (April 27, 2011)
  Undergraduate student achievements and awards (e.g., Goldwater Scholars, Man/Woman of the Year):

- **Will Frey (Physics '11) part of mathematics team that wins top honors in international competition** (May 2011)

- **Paper co-authored by Sara Case (Physics '12) and Clinton Durney (Physics '11) included in the Best of 2010 Collection of Europhysics Letters** (May 2011)

- **Research by Sara Case (Physics '12) and Clinton Durney (Physics '11) highlighted in Europhysics News** (May 11, 2011)

- **Physics undergraduate Siddharth Venkat presented Outstanding Undergraduate Research Award in College of Science** (May 11, 2011). Venkat was also named the 2011 Phi Kappa Phi Outstanding Senior for the College of Science.

- **Physics undergraduate Charles Baker receives the Barry M. Goldwater Scholarship** (April 14, 2011)

- **Charles Baker (class of '12) selected as 2010-11 ACC Undergraduate Research Scholar** (November 5, 2010)

Grants in teaching and learning (e.g., PhysTec):

- **Virginia Tech joins APS teacher education project** (June 6, 2011). The MOU and budget details are currently being negotiated. Roughly, $300K for 3 years, with university costsharing for 3 additional years, to sustain the program.
  Goal of the project: increase the number of highly qualified high school physics teachers, through increased recruitment of students into the physics major, early field experiences (with the Physics Outreach Team and the Montgomery County Schools Robotics
Program), early courses in pedagogy, and intense mentoring during the early years of high school teaching. First program of this kind in Virginia; 70 letters of intent invited for full proposals; five sites funded. Of these five sites, three (including Virginia Tech) will implement a wide range of activities while the remaining two are targeted on specific aspects of teacher education.

The Virginia Tech PhysTEC project addresses national, state, and university priorities:

*National:* The National Academies, in “Rising Above the Gathering Storm” (2006) called for “10,000 Teachers Education 10 Million Minds”. Focused on K-12 education, this was the committee’s unanimous highest priority:

  “Provide 10,000 new mathematics and science teachers each year by funding competitively awarded 4-year scholarships for U.S. citizens at U.S. institutions that offer special programs leading to core degrees in mathematics, science, or engineering accompanied by a teaching certificate. On graduation, participants would be required to teach in a public school for five years and, one hopes, beyond that time by choice.”  
  [From: Rising Above the Gathering Storm, Revisited: Approaching Category 5, p. 20]

*State:* In his proposed “Top Jobs of the 21st Century” legislation, Governor McDonnell has called for an additional 100,000 undergraduate (associate and bachelor’s) degrees for Virginians over the next 15 years by (1) increasing enrollment of Virginia students, (2) improving graduation and retention rates, and (3) assisting students with some college credit to complete degrees through public and private higher education institutions in Virginia. The proposed legislation “focuses additional degree attainment in high-demand, high-income fields (e.g., STEM, healthcare) that are keys to top jobs in 21st Century economy. Provides for creation of a not-for-profit STEM public-private partnership to fully engage the business and professional communities in the strategic direction and promotion of STEM initiatives. Incentivizes public-private collaboration on STEM-related and other commercially viable research.”  

*Virginia Tech:* Building on considerable strengths, Virginia Tech is embarking on a major initiative to innovate existing and create new undergraduate programs, including a strong focus on STEM education and teacher licensing and professional development. The university’s 15th president, Dr. Charles Steger, together with the leaders of some 120 other public universities, recently presented a letter to President Barack Obama pledging to address the national shortage of science and mathematics teachers through the Science and Mathematics Teacher Imperative (SMTI), sponsored by the Association of Public and Land-Grant Universities (APLU). VT’s 2006-2012 University Strategic Plan specifically lists PK-12 enhancements in science, technology, engineering and mathematics (STEM) education as a key goal, to be realized by an expansion of PK-12 STEM teacher preparation programs and of partnerships with schools, and the development and implementation of a continuum of recruitment, from PK-12 to STEM undergraduate programs to STEM-education graduate programs. The VT PhysTEC
project matches these goals and strategies perfectly. Many of the critical seeds are already in place: a strong partnership between the Department of Physics and the School of Education, a well-matched Physics BA and MAED program, and excellent contacts to Virginia schools. The PhysTEC project will provide the momentum to bring these seeds to full fruition. [From our successful proposal]

One to two notable events or programs related to undergraduate education (e.g., first year of a signature course or FYE):

- Physics launches first Virginia Tech signature experience (August 27, 2010)

- Physics receives a $22,000 Pathways to Success grant, to re-invent the Seminar for Physics Majors (PHYS 2325 and 2326) as its First Year Experience. The new FYE course will begin Fall 2011. Key goals: (1) Introduce students to scientific problem solving in an intentional fashion, using approaches and findings from physics education research; (2) Emphasize “soft skills” – writing, public speaking, networking; (3) Enhance all aspects of career advising for physics majors.

- Jon Link has been developing an online version of PHYS 2306 (part of our calculus-based introductory physics sequence) which will run live for the first time in Summer II. The work is supported by an Enterprise Grant of $10,709 from IDDL. A very innovative component of this project is the implementation of the laboratory experience: PHYS 2306 is a 4 credit hour class, including a 1 credit lab. In collaboration with Peter Macedo from IDDL, Link has identified a commercial vendor of lab kits which the students can work with remotely. The development of our suite of online courses continues in Fall 2011 with PHYS 2305; eventually, we hope to offer PHYS 2205 and 2206 (algebra-based introductory physics) as well.

Learning: Graduate

Graduate student achievements and awards (incl. college, university and national awards):

- Paper by Prof. Rahul Kulkarni’s group featured among Physical Biology's "Most Read articles (May 27, 2011). Tao Jia is a current graduate student in the department and Andrew T. Fenley received his PhD from us in 2010 and is now a postdoc at UCSD. Vlad Elgart was Michel Pleimling’s postdoc and collaborated with Kulkarni; since February 2011 he is a postdoc at Stanford.

- Martin Rudolph named Featured Graduate Student for April 2011 (April 1, 2011)
- Ph.D. student Ulrich Dobramysl, advised by Prof. Uwe Täuber, selected for 2011 Virginia Tech Sigma Xi Student Research Award (March 7, 2011)

- Article by Hyunhang Park and Prof. Michel Pleimling included in Editor's Suggestions of the Physical Review (October 12, 2010). Hyunhang is a graduate student in Physics.

**Grants related to graduate education (e.g., IGERTS):**

- Pleimling was Co-PI on a full IGERT proposal led by computer science (see below); Schmittmann served in the same role on a full IGERT proposal on network science for infrastructure management; unfortunately, neither got funded.
  - **CS IGERT:** Integrative Computational Science and Engineering via Multi- and Many-Core Parallel Computing
  - **Network Science IGERT:** “Uncovering Network Interdependencies and Synergies (UNIS)”

**One to two notable events or programs related to graduate recruitment and/or education:**
Nothing significant to report. We held our annual Graduate Preview Weekend on 2/18-19.

**Discovery**

**Faculty awards/honors (e.g., NSF CAREER awards, Humboldt Fellowships):**

- Paper co-authored by Prof. Djordje Minic wins fifth place in Gravity Research Foundation's 2011 Awards for Essays competition (May 17, 2011)

- Prof. Beate Schmittmann named Outstanding Referee by the American Physical Society (April 20, 2011)

- Profs. Michel Pleimling and Tatsu Takeuchi honored at VT Authors Day 2011 (February 17, 2011)

- Obituary for Prof. Richard Arndt featured in *CERN Courier* (January 25, 2011)

- Prof. Nahum Arav featured in "Spotlight on Innovation" (January 24, 2011)

- Prof. Beate Schmittmann receives the Beams Medal of the Southeastern Section of the American Physical Society (November 23, 2010). The citation reads: “For deep and pervasive contributions to nonequilibrium statistical mechanics and its applications and for inspiring world-class research in the southeastern United States.”
• **Prof. Leo Piilonen appointed William E. Hassinger, Jr. Senior Faculty Fellow in Physics** (September 24, 2010)

• Nahum Arav was awarded a prestigious Lady Davis fellowship, supporting a 3 months visit to the Technion, Israel for summer 2011; delayed until summer 2012 for family reasons

**Notable research awards (incl. PIs, Amount, Title and Funding Agency):**

• Patrick Huber, U.S. Department of Energy, Office of High Energy Physics, Early Career Research Award (ECRA), *Neutrinos in the Universe*, April 15 2010 – April 14 2015, $750,000 for five years, PI (100%). Extremely competitive young investigator award; DOE’s equivalent of NSF’s CAREER program; 1750 applications, 69 awards.

• Giti Khodaparast, continuing NSF Career Award: “Integrated Research and Education to Probe Coherent and Quantum States in the Presence of Strong Spin-Orbit Coupling”. 2009-2014, $550,000.

• Jon Link, continuing DOE Outstanding Junior Investigator Award, “Experimental Studies in Neutrino Masses and Mixing Angles,” funded at $360,000 (2008-2012). The OJI program was DOE’s equivalent of the NSF’s CAREER program until 2009 when the ECRA program was launched.

**Number of manuscripts, number of books and book chapters (CY 2010); high impact papers:**

Books published: 2
Book chapters published: 3
Refereed articles published: 97 In press: 26 Submitted: 38
Proceedings published: 10 In press: 4 Submitted: -

• **Prof. Michel Pleimling publishes book on physical aging** (August 17, 2010):

• Tatsu Takeuchi, “An Illustrated Guide to Relativity” Cambridge University Press (September 9, 2010 in the UK, October 18, 2010 in the USA)

• K. Park, J. J. Heremans, V. W. Scarola, and Djordje Minic, “Robustness of topologically protected surface states in layering of Bi\textsubscript{2}Te\textsubscript{3} thin films”, Physical Review Letters **105**, 186801 (2010).

Charles Bowman and Bruce Vogelaar, Handbook of Nuclear Engineering (Springer) Vol 3: Nuclear Power Reactors, Chapter “Molten Salt Reactor Design”

**Number of presentations (CY 2010); selected notable invited lectures:**

Presentations: Invited: 79 Contributed: 128

- Kyungwha Park, invited talk at the 6th International Workshop on Nanomagnetism and Superconductivity, Coma-Ruga, Spain, July 2, 2010: “Antiferromagnetic coupling between the single-molecule magnet Mn12 and ferromagnetic substrate”
- Raju Raghavan, invited lecture at the Nu-GeoScience Workshop, Laboratori Nazionali del Gran Sasso, Italy, October 2010: “New Physics from MeV Neutrino Sources brighter than a Thousand Suns”
- Vito Scarola, invited lecture at the International Workshop on Topological Order and Quantum Computation, lead and organized by Microsoft Station Q Staff at the Richard B. Gump South Pacific Research Station Moorea, French Polynesia: “Experimental Evidence for New Even-Denominator Fractional Quantum Hall States: Abelian or non-Abelian?” [Station Q is the research arm of Microsoft, focused on fundamental issues in quantum information.]
- Eric Sharpe has given a number of invited plenary or key note lectures. Here is a selection:
- Workshop on *Categorical methods in geometry and gauge theory*, Tianjin, China, August 29 –Sept. 3, 2010, talk title: ``An introduction to quantum sheaf cohomology’’
- Workshop on *(0,2) mirror symmetry and heterotic topological strings*, Erwin Schrodinger Institute, Vienna, Austria, June 20-24, 2011

- Uwe Täuber gave a series of four lectures at the Schladming International Winter School *Physics at All Scales: The Renormalization Group*, Schladming, Austria, February / March 2011.

**Engagement**

*Faculty service (Editorships, NSF/NIH program managers or panel members, leadership positions in professional societies):*

- **Prof. Beate Schmittmann** named Outstanding Referee by the American Physical Society (April 20, 2011)

- Department receives Services for Students with Disabilities Office 2011 Excellence in Access and Inclusion Award (March 30, 2011)

- **Prof. Michel Pleimling** elected as Member-at-Large, serving the Southeastern Section of the American Physical Society (SESAPS) (November 17, 2010)

- **Prof. Royce Zia** presents talk at the Science Café in Postsdam, New York (October 13, 2010)

- Randy Heflin: Scientific Advisory Board Member of Techulon; Editorial Board Member of International Journal of Nanoscience; Member of Organizing Committee for International Symposium on Clusters and Nanostructures, November, 2011.

- Jean Heremans and Giti Khodaparast (as well as Lou Guido, MSE): Co-organizers of upcoming 15th International Conference on Narrow Gap Semiconductors and Systems, Blacksburg, VA, August 1-5, 2011. Conference contents, organizational details, fund raising, and grant writing for financial support.

- Jean Heremans is active in APS FIAP (Forum on Industrial and Applied Physics of the American Physical Society). This involved discussions on topical groups for electronic device physics and energy sustainability.
Patrick Huber: Chairman of the Physics and Performance Evaluation Group of the International Design Study for a Neutrino Factory (IDS-NF); Organizer of the 5th IDS-NF plenary meeting, FNAL, April 8-10, 2010 and the 6th IDS-NF plenary meeting, RAL, UK, September 22-25, 2010

Giti Khodaparast: COS Cluster Committee; ICTAS Advisory Board.

Jon Link: Served on an NSF Review Panel for the Physics Frontier Centers program; also serves in a leadership position for the Daya Bay Collaboration

Leo Piilonen serves in a leadership position for a large international experiment, the Belle Collaboration; he is assuming a similar role for the next stage of this experiment, the Belle II Collaboration. Specifically, he serves as a member of the Belle Executive Committee (one of Belle’s two management bodies), as the Chair of the Belle Institutional Board (one of Belle’s two management bodies), as a member of the Belle Publication Council (final refereeing body for all papers), and as Belle Authorship Manager (for all physics-journal publications). He is a member of the Belle II Executive Committee (one of Belle II’s two management bodies) and the Chair of the Belle II Institutional Board (one of Belle II’s two management bodies)

Mark Pitt serves in a leadership position for two highly regarded experiments at Jefferson Lab: He serves as a member of the Executive Committee of the Qweak experiment, and he is a member of the Steering Committee for the JLAB 12 GeV MOLLER experiment. The second experiment is part of a significant upgrade of the JLab facilities which will see the lab into the next two decades.

Michel Pleimling continues to serve as a reviewer for the European Commission in the framework of the Marie Curie Fellowships.

Michel Pleimling and Beate Schmittmann co-organized an International Symposium *Complex driven systems - from statistical physics to the life sciences* that took in Blacksburg, VA, in October 1-3, 2010.

Pleimling also organizes, together with Malte Henkel (Nancy, France), David Mukamel (Rehovot, Israel), and Gunter W. Schütz (Jülich, Germany), the Seminar *Large Fluctuations in Non-Equilibrium Systems* that will take place at the Max-Planck-Institut für Komplexe Systeme in Dresden/Germany in July 4-15, 2011.

Vito Scarola is a member of the ALPS collaboration (Algorithms and Libraries for Physics Simulations: alps.comp-phys.org). This project seeks to collect numerical algorithms used to study condensed matter phenomena into one comprehensive framework freely available to researchers and students. My group is working with computer scientists heading the Vistrails project, C. Silva (U. Utah) and J. Freire (U. Utah), to combine ALPS with Vistrails. The resulting visualization based code will be easy to use thereby allowing students at the undergraduate and graduate levels to learn the basics of computational condensed matter with modern codes. The programs in the
ALPS projects are freely distributed to the community via the website. The software will give students and researchers in disadvantaged areas immediate access to cutting edge research and learning tools.

- Schmittmann, Piilonen, and Pleimling are the local organizers of the 78th Annual Meeting of the Southeastern Section of the American Physical Society (SESAPS 2011) that will take place in Roanoke, VA, in October 19-22, 2011. Together with the SESAPS Executive Committee, they are also responsible for the scientific program at the meeting.

- Beate Schmittmann is a Member of Editorial Board for American Journal of Physics. She is also the American Physical Society Representative (“Friend of APS”) for Virginia Tech. She served as a member of the Selection Committee for the 2011 APS Onsager Prize. This prize is the premier US recognition for seminal contributions to theoretical statistical physics. She was recently nominated to serve as new member and U.S. representative on the C3 Commission (Statistical Physics) of the International Union of Pure and Applied Physics (IUPAP). If the nomination is approved by the American Physical Society and IUPAP, her three year term will begin in November 2011.

- Eric Sharpe serves as organizer or co-organizer of multiple conferences, workshops, or summer schools:
  - Organized informal meetings of southeastern area string theorists held at Duke University on April 2, 2010, October 16, 2010, and another to be held in April 2011
  - Co-organizer of workshop held in Banff, Canada, March 8-12, 2010
  - Co-organizer of special session of southeastern regional AMS meeting (Lexington, KY, March 27-28, 2010)
  - Co-organizer of graduate summer school on mathematical string theory, June 20 – July 3, 2010, held at Virginia Tech.
  - Co-organizer of String-Math 2011, inaugural meeting of a large international conference series, to be held at the University of Pennsylvania on June 6-11, 2011.

- Uwe Täuber serves on the Editorial Board of Physics Research International (formerly Research Letters in Physics). He is also an Advisory Panel member for the Journal of Physics A: Mathematical and Theoretical.

- Bruce Vogelaar serves as the Director of KURF – The Kimballton Underground Research Facility. KURF added two new institutional users this past year: NIST/UMd and Princeton. That brings the total to 8, including VT, NCSU, UNC, Duke, UAi, BNL. (In 2011, KURF has been approached by groups from Notre Dame and Yale regarding an accelerator for nuclear astrophysics.) He spends significant time and effort on improving the infrastructure and operation of the facility.

- Vogelaar was also one of the organizers of the 1st International Workshop on Accelerator Driven Systems and Thorium Utilization. This was a major international
workshop on ADS systems with 57 attendees from around the world. The workshop and talks can be found at: http://www.phys.vt.edu/~kimballton/gem-star/workshop/index.shtml.

Examples of economic development (e.g., industrial partnerships, patents):


- U.S. Patent Application # 61/390,894, VTIP No.: 11-041 “Detection of Special Nuclear Materials in Cargo Containers”, Patrick Huber and Jonathan M. Link Date Filed: October 7, 2010


Study Abroad programs:

- NA

PK-12 STEM programs:

- Physics Outreach Team wins the 2011 College of Science Award for Outreach Excellence (May 12, 2011)

Community and Student Engagement:

- Physics Outreach Team wins the 2011 College of Science Award for Outreach Excellence (May 12, 2011)


- Prof. Nahum Arav gives special lecture for Students for the Exploration and Development of Space (April 6, 2011)

- Prof. Royce Zia presented a public talk at the Science Café in Postsdam, New York (October 13, 2010)

- Nahum Arav gave a public talk at Roanoke College: “The Paranormal Universe”

The Physics Department hosted several public lectures this year:
- World-renowned science educator and speaker, Jearl Walker, puts everyday ’spin’ on physics (April 11, 2011)
- Deputy director of Fermilab to speak on frontier physics, cosmology (April 5, 2011)
- Blind physicist Aziza Baccouche presents motivational talk (March 17, 2011)

Beate Schmittmann presented a public lecture at Wake Forest University: “New physics all around us.” (March 30, 2011).

John Simonetti was involved with various activities serving the local and alumni community:
- He was lecturer for one day in the Astronomy Elderhostel given at the Mountain Lake Hotel and Wilderness Conservancy. Lectured on “Cosmology.” October 18, 2010.
- Interviewed for an article that appeared in the Virginia Tech Magazine, on “Physics and Football.” Article appeared in the Fall 2010 issue.
- Guest speaker for a lunch question and answer discussion for high school students in the NASA INSPIR, Summer Collegiate Experience, at Virginia Tech, July 8, 2010.
- Coordinator of Public Open Houses at the Prices Fork Observatory

Diversity

One to two notable activities by students, faculty and/or staff activities promoting diversity:

- Tatsu 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 and help students prepare presentations in English, and write papers in English.

- Patrick Huber and Giti Khodaparast hosted undergraduate researchers from the University of Texas at El Paso, a minority-serving institution. Jean Heremans and Vicki Soghomonian hosted Anthony Sigillito, a Hispanic student from the University of Dallas, Irving, TX, as part of an REU experience. Soghomonian also mentored several African-American students on various research projects.
• Schmittmann served as Co-PI on Virginia Tech’s Advance grant. The grant finally ended in August 2010.

Diversity awards and honors (e.g., MAOP scholarships; McNair Scholars):

• Department receives Services for Students with Disabilities Office 2011 Excellence in Access and Inclusion Award (March 30, 2011)

Other notable items: Books, talks, events, images, movie clips, etc

• Books published:
  o Henkel, M., and Pleimling, M., Nonequilibrium Phase Transitions Volume II – Ageing and Dynamical Scaling Far From Equilibrium, 544 pages (Springer, 2010)

• Image from collaboration by Prof. Giti Khodaparast and Prof. Jill Sible featured on cover of Biotechnology Journal (April 11, 2011):

  Prof. Giti Khodaparast and Prof. Jill Sible, professor of biological sciences and Associate Dean for Curriculum, Instruction, and Advising in the College of Science, have been collaborating in delivering nanoparticles to cells using a near infrared laser technique. One of the resulting tadpoles is featured on the cover of the May 2011 issue of Biotechnology Journal! The lead author of the project is Jose Umanzor-Alvarez (Physics class of 2010).  
  Attached file: Biotech cover 481_ftp.pdf

• World-renowned science educator and speaker, Jearl Walker, puts everyday 'spin' on physics (April 11, 2011)

• Deputy director of Fermilab to speak on frontier physics, cosmology (April 5, 2011)

• Blind physicist Aziza Baccouche presents motivational talk (March 17, 2011)

• Image by Prof. Uwe Täuber featured in Physical Review E's "Kaleidoscope" (December 7, 2010)  

• "Planets, Galaxies, and Star Stuff" with Prof. Nahum Arav [VIDEO] (September 10, 2010)
• In 2010, the Department of Physics launched a new center, the “Center for Neutrino Physics” (CNP). The center organizes all particle and nuclear research in the department into a new entity whose goal is to promote and further the science relevant to the group members, with a special emphasis on neutrinos, through visitors programs, seminar series and targeted workshops. Patrick Huber and Jon Link developed the vision, worked with potential center members to write a charter document, and with the Research Division, the College of Science, and the department to establish an overhead return model for the center. The Center was formally approved in mid-2010, and Leo Piilonen serves as its first Director.

• Leo Piilonen was selected as the first William E. Hassinger, Jr. Senior Faculty Fellow in Physics (three-year term, starting Fall 2010). This is an Eminent Scholar position.

• Hans Robinson worked with ICTAS, the Controller’s Office, and the Department to establish a new service center, the “Center for Nonlinear Imaging and Spectroscopy. Robinson requested and secured the transfer of a Zeiss laser scanning microscope with associated femtosecond laser from ICTAS to the Physics department. This $650,000 instrument is now located in space belonging to Physics in the new ICTAS II building. He also helped secure funds from ICTAS for a $35,000 spectrometer that will be used in conjunction with the microscope.