

PHYSICS

**A UNIVERSITY
EXEMPLARY
DEPARTMENT**

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Quanta

A publication for the faculty, staff, students, alumni
& friends of the Virginia Tech Physics Department

Physics receives exemplary recognition

Virginia Tech's Board of Visitors announced the University Exemplary Department Awards for collaborating across departmental boundaries to achieve common goals.

The departments of Electrical and Computer Engineering (ECE), Materials Science and Engineering (MSE), and Physics received the top \$10,000 Exemplary Department Award. The Graduate Program in Science and Technology Studies received a \$5,000 award, and another \$5,000 award went to the Department of Foreign Languages and Literatures' French section and the Pamplin College of Business Graduate and International Programs. Provost Mark McNamee presented the awards.

The Office of the Provost established the awards in 1994 to recognize the work of departments and/or programs that maintain exemplary teaching and learning environments for students and faculty. Each year, the awards committee selects a different focus for recognition.

"Collaborations among faculty from different departments enrich the university's educational and research efforts. In recent years, such collaborations have become increasingly important since many new fields of study cross a number of disciplinary boundaries," said Ron Daniel, associate provost for undergraduate education, who oversees the Exemplary Department Awards program. "The provost's office is pleased to see such strong working relationships being forged throughout the university."

Several professors in the departments of ECE, MSE, and Physics have collaborated to strengthen Virginia Tech's academic and research programs in microelectronics, optoelectronics, and nanotechnology. These professors realized "it was essential to reinvent the way in which these subjects were taught and the manner in which we conducted research," said Robert Hendricks, professor of ECE and MSE and a leader in the collaboration.

With support from the Pratt Foundation and the Virginia Microelectronics Consortium, the faculty team and the departments established the Center for Microelectronics, Optoelectronics, and Nanotechnology (MicrON). "The departments have worked very closely to develop integrated, cross-disciplinary curricula and to establish central facilities that advance the research activities of faculty throughout the university and foster interdisciplinary collaborations," said James R. Heflin, associate professor of physics.



- see Exemplary Award pg.2-

Exemplary Award

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The collaborative efforts attracted a National Science Foundation grant to develop a curriculum of more than 10 sophomore-to-graduate-level courses spanning the fields of microelectronics, optoelectronics, and nanotechnology. Faculty collaborations have also led to new research grants and projects, funding to build and equip four teaching and research laboratories, funding to support graduate students from several departments, and a proposal for a minor in microelectronics engineering. Virginia Tech students have been the major beneficiaries of this collaboration.

Physics received its first Exemplary award in the Fall of 1999 and can now remain exemplary for another five years.

"Thanks to all those who have contributed their time and talents to foster collaborative efforts with ECE and MSE; and special thanks to Lay Nam Chang and Randy Heflin for establishing the key teaching and research collaborations with ECE and MSE that have made this award possible."

- John F. Ficenc -

NSF grant to advance faculty women in science, engineering

Using a \$3.5-million institutional-transformation grant from the National Science Foundation's (NSF) ADVANCE program, the university will identify barriers that can keep women faculty members from choosing, remaining in, or advancing in science and engineering, and will develop ways to promote and enhance the careers of women in these disciplines.

The overall goal of the NSF ADVANCE program is to get more women involved in the scientific and engineering

workforce by increasing the representation of women in academic science and engineering careers at all levels, particularly in leadership roles.

"Throughout the country, female faculty members in science and engineering encounter obstacles that discourage them from pursuing these fields or hinder their progress and satisfaction," said Mark McNamee, university provost and vice president for academic affairs.

"The NSF grant will provide us with the resources to identify and change the factors that contribute to low representation and stalled advancement. At the end of the five-year project, we anticipate becoming a model for other institutions to follow," McNamee said.

Virginia Tech has had relatively few women faculty members in the sciences and engineering during its 131-year history. In the fall of 2002, when the grant proposal was written, 8 percent of the faculty members in the College of Engineering were women, while in the departments that now comprise the College of Science, 16 percent of the faculty members were women.

"In general the women in the sciences and engineering disciplines disappear or don't move up," said Patricia B. Hyer, associate provost for academic affairs and principal investigator on the project. "This NSF award will allow us to identify institutional barriers that constrain the advancement of women faculty members in these areas. We plan to target institutional culture, practices, and leadership development needs specific to this university," she said.

"Several women assistant professors have already joined the engineering faculty this fall," Hyer added, "giving us a good start on achieving the project goals."

Four ADVANCE professors have been named to serve on the project leadership team: Nancy Love, associate professor of civil and environmental engineering, and Karen Thole, professor of mechanical engineering, to represent engineering, and **Beate Schmittmann**, professor of physics, and Catherine Eckel, professor of economics, to represent the sciences. Elizabeth Creamer, associate professor of educational leadership and policy studies, is director of assessment for the project. Peggy

advanceVT

Further information about the Advance program can be found on their website at: <http://www.advance.vt.edu/>

- see NSF Grant pg 7 -

Nanoscience and technology important focus for researchers

Since President Bill Clinton announced “a major new national nanotechnology initiative” in 2002, researchers at Virginia Tech have made important advancements, the Board of Visitors learned at its recent meeting.

A nanometer is about the size of 10 atoms. Nano-scale materials offer new or enhanced mechanical, electronic, magnetic, optical, solubility, and spatial-resolution properties. “Scientists are following nature’s example in assembly of materials atom by atom. It’s very efficient,” said Robert Porter, research program development manager and Virginia Tech’s representative on the steering committee of the state-wide nanotechnology initiative, INannoVa. An oft-cited example of the potential of nanotechnology, included by Clinton, is replacing the capacity of today’s room-sized super-computers with a molecular device the size of a sugar cube.

However, the fact that materials behave differently at the molecular and submolecular level than they do in bulk means that many applications will come only after basic research to understand and predict the properties and functions of nano-scale materials and devices.

Materials Science and Engineering Department Head David Clark and Physics Department Chair John Ficenec told the board that, having received significant funding and begun work in such fields as biomedicine, electronics, and materials, the university’s nano-technology initiative is being “ramped up.”

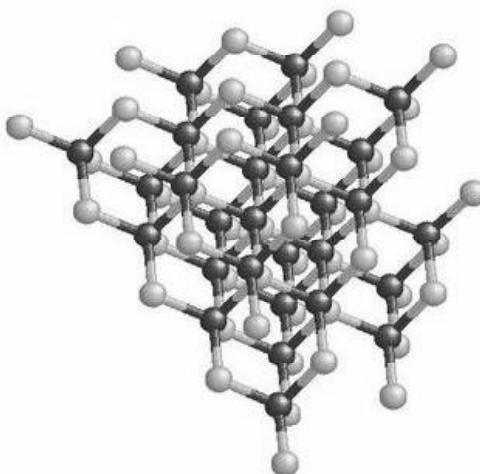
“Our goal is to position Virginia Tech to compete for multi-million dollar grants,” Clark said. He told the Board of Visitors that the focus for nanotechnology research at Virginia Tech is biomedicine, defense and homeland security, electronics and information technology, and energy and

environment applications.

“The university has a solid foundation and a significant portion of the science and engineering faculty oriented to the nanotechnology revolution.” Ficenec said.

“We have made significant contributions. Now, with searches under way in the Colleges of Engineering and Science for 12 additional faculty members who will be doing nanoscience and technology research, Virginia Tech is well-positioned to be a leader in nanotechnology.”

Chemistry Professor Harry Dorn is a nanoscience pioneer. When a new form of carbon, a hollow molecule named after architect Buckminster Fuller, was discovered in the 1986, Dorn and other scientists world-wide began to try to put atoms inside of it. In 1999, Dorn reported in *Nature* that he and his post-doctoral fellow, Steven Stevenson, had discovered a method for inserting metal atoms inside of




fullerenes, creating a novel family of molecules and the architecture for a new field of chemistry.

Since 1999, Dorn has received more than \$435,000 in research funding -- \$222,000 from NASA, and his filled fullerenes are now being developed by Luna nanoMaterials of Blacksburg as improved MRI reagents. The next goal for scientist around the world was to enable fullerenes to travel through the blood stream.

Last year, Dorn’s Ph.D. student Erick B. Iezzi developed the first organic derivative of a fullerene. He figured out how to attach an organic group to the carbon molecule, bringing fullerenes a step closer to biological applications, such as the delivery of medicine of radioactive material to a disease site. Iezzi received a \$20,000 Graduate Fellowship from the American Chemical Society to continue his work.

Clark told the Board of Visitors that the benefits that accrue to the university as a result of leadership in nanotechnology research include national and international prestige; enhanced ability to recruit outstanding faculty members; more applications from doctoral students wanting to study nanoscience and technology and affiliated fields; more research funding, which supports students, pays for equipment, and provides overhead for university research space, including labs where undergraduate and graduate students gain experience; education, and public use; and intellectual properties that offer the potential of technology transfer, spin-off businesses, new products, and reinvestment in research.

“Nanotechnology is the next scientific epoch. Its impact will be pervasive. We are on the cusp of a new age,” Porter said. 

Article courtesy: Susan Trulove

Jamie Dunn Award
Mitra Shojania-Feizabadi

Ray F. Tipword Graduate Scholarship
Edward Lyman

Lubna Ijaz
Brian Donovan

Frank Leigh Robeson Scholarship
Laura Triplett
Wade Mattox

Webster & Sara Schoene Richardson Memorial Scholarship
Michael Robertson
Brett Spencer
Colin Beal

Hugh D. Ussery Scholarship
Samir Abboud
Linh Pham
Geoffrey Adams
Eric Ward

Col. Nelson Carey Brown Memorial Scholarship
Richard Foster

Robert P. Hamilton Prize
Mark Washenberger

Daniel C. & Delia F. Grant Endowed Scholarship
David Erickson
Christopher Luck
Matt Raum
Sean Settle
Mark Washenberger

Robert C. Richardson Scholarship
Brian Skinner
Travis Merritt
Heike Lohse-Busch
JungHo Kang
Xinwei Gong
Annalisa Pawlosky

H.Y. Loh Award
Justin Krometis

Kimballton: A unique underground science and engineering opportunity

Recent interactions with the Kimballton mine in southwestern Virginia have created an exciting science opportunity for the Physics Department, Virginia Tech, regional universities, and both national and international colleagues. The Low Energy Neutrino Spectrometer (LENS) is a next generation (~\$100M) precision underground solar neutrino detector that is ready to move to the prototype stage – and Kimballton is an ideal site for the full experiment. Virginia Tech and Chemical Lime of Virginia are exploring ways to make this a reality.

As a flagship physics experiment, LENS would pave the way for other experiments at Kimballton. Scientists at the Naval Research Laboratory (NRL), in collaboration with Virginia Tech, are developing a low-level counting facility for Kimballton while other institutions have also requested space. Kimballton offers a unique

interdisciplinary platform for research beyond physics. The geosciences, geoengineering, and mining communities, both at VT and elsewhere, are all interested in a dedicated underground laboratory to study varied topics such as Computational geomechanics; Sensor technology; Geovisualization; Fracture processes; Rock engineering; Geobiology; Extreme environments; and Seismicity to mention a few..

The National Science Foundation has initiated a process to identify the best available site for development of a Deep Underground Science and Engineering Laboratory (DUSEL). The Kimballton site, if selected, offers many desirable features in an underground facility including:

- Tractor-trailer drive-in access
- Current depth of 2300 ft
- 50 miles of drifts, typically 42 ft wide, 26-110 ft high, one mile long
- Environmentally benign site, both underground and on the surface
- Simple geology and tectonically stable
- Located within 30 minutes of VT, a major research university
- Easy access by air or interstate highway

The Virginia Tech Physics Department has built a strong collaborative effort for this within the University, crossing departmental and college boundaries. As a result, Virginia Tech will provide \$1.6M for preliminary geologic and engineering studies to explore going to a depth of 7000 feet; hire Dr. Raghavan as a senior-level physics faculty member in the neutrino physics field; and has identified the DUSEL project as the founding initiative in the recently established Advanced Studies Institute within the College of Science with **Dr. Vogelaar** as one of its first fellows. For further information, please visit <http://www.physics.vt.edu/~kimballton>. ⚙️

Article and photo courtesy: Bruce Vogelaar



Physics Outreach holds hands-on fun in science class


The Virginia Tech Physics Outreach held a *“Hands-on fun in science class”* for fifth graders at Willis Elementary School on October 24, 2003, where several demonstrations were performed. The outreach presentation at Willis Elementary is an annual introduction unit to preview what science students are studying.

Students had the opportunity to learn about static electricity, jumping rings, lights and total internal reflection, momentum, and air pressure. The demonstrations allowed for student participation, giving them a hands on experience with the many aspects of science.

The Outreach program of the Physics Department helps fulfill the mission of the university’s extension service.

Graduate or undergraduate students who have an enthusiasm for helping students learn

about the fundamental aspects of physics go out to surrounding elementary, middle and high schools to conduct activities and demonstrations, or host students in Robeson Hall.

To request a visit to your school, or to schedule a time for your students to visit Virginia Tech’s Physics Department for an Outreach Demonstration, please contact Burke Green (hegreen2@vt.edu) for more information. Please feel free to visit our website at: <http://www.outreach.phys.vt.edu>. 



COLLEGE OF SCIENCE

HOME COMING

2004
WEEK



september 27 - october 2 ■ hokies vs. west virginia

visit www.cos.vt.edu for upcoming details
game tickets and lodging available to those who register

Physics Symposium

“A SYMPOSIUM ON BIOLOGICAL PHYSICS”



Left to right: Royce Zia, Sue Liebman, Beate Schmittmann, Alan McKane (University Manchester, England) and Leah Shaw

Biological systems and soft materials pose fascinating and complex challenges for physicists. The past decade has seen an enormous explosion of available data in the life sciences, and biologists are increasingly recognizing the need for quantitative modeling and analysis. ‘Soft’ materials, such as polymers and colloids, constitute some of the fundamental building blocks of biological systems. Researchers from statistical physics, due to their extensive expertise with complex interacting systems, both near and far from thermal equilibrium, are uniquely poised to contribute to the characterization and theoretical modeling of biological structures and processes.

To discuss some of the exciting new problems posed by biological systems, the Physics Department hosted an interdisciplinary conference on Saturday and Sunday, March 6 and 7, 2004, with the title:

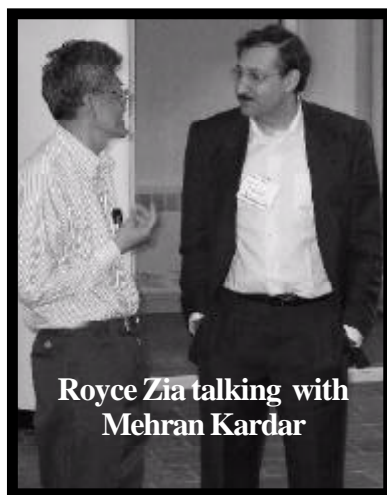
Biological Systems and Soft Materials: Future Directions in Statistical Physics. Beate Schmittmann and Uwe Täuber were the local organizers, with help from Per Arne Rikvold (Florida State) and Bulbul Chakraborty (Brandeis). About 70 participants, coming from all over the East Coast, assembled in our new lecture theater in the Physics/Chemistry Building to listen to seven invited and 24 contributed talks. The symposium was supported by NSF, Virginia Tech, and the journal “Physical Biology”.

One of the invited speakers was our Alumna, Leah Chock (née Shaw) who is currently finishing her PhD dissertation at Cornell. She discussed her research on predicting protein concentrations based on known concentrations of different types of mRNA in a cell or test tube. Sue Liebman, a well-known

biologist from the University of Illinois at Chicago, spoke about “Prion-prion interactions in yeast”. Prions are proteins which can fold into a “good” and a “bad” structure. When misfolded, they give rise to diseases such as mad-cow. Fortunately, as Liebman pointed out, such misfoldings occur only very rarely! Another very elegant talk was given by Mehran Kardar from MIT, who considered how symmetries found in nerve structures of the visual cortex and in natural images relate to one another and how they can be described by local vector fields. Other talks focused on crystallization of globular proteins, mathematical models for population dynamics, cell self-organization and motility, and DNA-gold nanoparticle assemblies.

Saturday night, everyone headed to the Hunan Restaurant for a special banquet, to honor Royce Zia who turned 60 last December. He is very well known in the international statistical physics community for his research and his warm personality, and both were recognized in funny-sweet after-dinner speeches. Joe Redish, a long-time friend from undergraduate days (now at the University of Maryland), discussed the properties of the $R_{k-p}(z)$ function,

- see Symposium pg 7 -



Royce Zia talking with Mehran Kardar



Jim Gunton
Lehigh University



Speakers and participants, including many students, during break.




NSF Grant

continued from page 2

Lane, a former national president of the Society of Women Engineers, has been hired as coordinator to oversee project activities.

Hassan Aref, dean of engineering, predicts that the grant will stimulate changes for the College of Engineering. "My hope," he said, "is that we will be able to recruit at least two women into department headships as these positions become vacant over the next five years. In addition we should see several women assume technical leadership roles in the college, for example, as center directors or as principal investigators on major collaborative grants. These women faculty members will be great role models for more junior colleagues and for graduate students and postdocs."

Lay Nam Chang, dean of the College of Science, said "maximizing the contributions of every scientist is integral to the advancement of knowledge in our various disciplines. For this reason, the College of Science is actively participating in the NSF ADVANCE program. Our commitment to this program mirrors our commitment to increasing the participation and advancement of women in academic science careers, which will result in the development of a more diverse and more capable workforce."

The ADVANCE project will consist of four program elements, including institutionalizing change, empowering women as leaders and scholars, increasing the representation of women, and advancing women into faculty careers. These four elements target women at different stages of their careers, from graduate student to faculty member to institutional leader. Among the activities planned as part of the project are, mentoring programs, granting opportunities, and a major campus conference. 


Four ADVANCE professors have been named to serve on the project leadership team: Nancy Love, associate professor of civil and environmental engineering, and Karen Thole, professor of mechanical engineering to represent engineering, and Beate Schmittmann, professor of physics, and Catherine Eckel, professor of economics, to represent the sciences. Elizabeth Creamer, associate professor of educational leadership and policy studies, is director of assessment for the project. Peggy Lane, a former national president of the Society of Women Engineers, has been hired as coordinator to oversee project activities.

Article courtesy: Clara B. Cox

Symposium

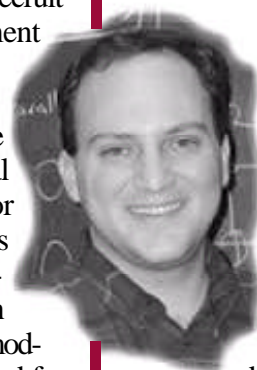
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and Beate Schmittmann described one of her first encounters with Royce Zia, during a late-night car ride on a narrow back road. Various students, collaborators and friends also had stories to add.


On Sunday afternoon, most participants headed home, after lots of friendly hugs and farewells. All agreed: it was a fun and exciting conference! 

Article and photo courtesy: Beate Schmittmann

Andrew J. Landahl - keynote speaker for the 2004 Physics Awards Ceremony



Dr. Andrew Landahl received B.S. degrees in Physics and Mathematics with a minor in Computer Science from Virginia Tech in 1996 and an M.S. and Ph.D. in Physics from Caltech in 2000 and 2002 respectively. He began exploring the possibility of quantum computing in his Virginia Tech Honors Thesis, under the direction of then department head and now College of Science Dean Prof. Lay Nam Chang. At Caltech, he became an active participant in shaping this nascent field, where he developed new fault-tolerant quantum computing architectures, continuous-time quantum error correcting codes, and quantum algorithms. He currently is a Postdoctoral Fellow at MIT supported by the Hewlett-Packard/MIT alliance, where he continues to work on problems that unify concepts in information theory and quantum mechanics. While at Virginia Tech, he was actively involved in expanding the Society of Physics Students, where he served as president for two years. He initiated several SPS outreach programs, helped garner an undergraduate research grant for the SPS chapter, and received the highest National SPS Scholarship. He also served as treasurer of the Virginia Tech Astronomy Club, fundraising chair of the Mortar Board National Honor Society, and is a member of Sigma Pi Sigma National Physics Honor Society. 

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To learn more on the different ways you can give, visit the Virginia Tech, Office of University Development - "Ways to Give" website at <http://www.givingto.vt.edu/waysgive.html>.

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*Thank you in advance,
John Ficenec, Interim Chair*

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