

Department of

FALL 2008

# PHYSICS *Newsletter*

## Welcoming the Largest Physics Class Ever!

Last year we made a commitment to increase Physics enrollment at the University. The resulting campaign successfully increased undergraduate levels by 60%.

Our successful campaign was due in part to many factors, the basis of which remained a strong, organized curriculum combining academics with excellent research opportunities.

Thirty-two new undergraduates will be joining our program this academic year. While the majority chose general physics, just over 30% have selected biophysics as their major and 10% have selected applied physics.

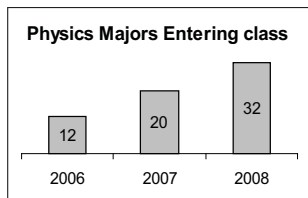
This year's students are from places as close as Boston and as far away as California. We even have an undergraduate from Spain, testifying to our international visibility!

While our current undergraduate program offers several dual majors, in addition to our traditional physics programs, we are building a comprehensive and flexible program

First year students attend the Intro to Physics class.



that will incorporate traditional disciplines, tailored to individual interests. The program is in response to increased interest for a blended curriculum. Our dual major and



joint major interdisciplinary offerings, as well as our advising and co-op functions, have expanded to provide more opportunities to our students.

Another attraction of Northeastern is our co-op program, which remains the best in the country.

## Graduate Program Grows

Following a targeted recruitment campaign, we received a significant increase in graduate PhD applications. Our incoming graduate class is up to 16, compared to 12 in the previous year. Significantly, seven of the students are graduates of US colleges and universities, among the highest we have ever welcomed. We are pleased to have such a strong graduate class.

With top-notch faculty and a wide range of research opportunities, it is easy to understand why students are looking at studying physics at Northeastern. We offer a rigorous program, accessible professors, and a campus surrounded by world-class research facilities and hospitals. Our students leave with a strong education and a competitive edge to start their careers or graduate school. ■

## NOTES FROM THE CHAIR

*We start the academic year welcoming the largest ever undergraduate class in Physics. We are also welcoming an impressive class of PhD candidates.*

*Our faculty continue to be highly productive and very visible in the academic community. They have traveled widely and have given numerous invited talks. During the calendar year 2007, Physics Department faculty published 211 papers, and made 104 presentations world-wide at prestigious conferences and academic institutions. Two were elected as Fellows of the American Physical Society and two have received prestigious awards.*

*Our research has received significant visibility in the academic and non-academic world. The discovery of the  $\Omega_b$  particle, the analysis of large scale human mobility patterns, and demonstration of nano-optical lenses were widely reported in the press, testifying to the large range of disciplinary and interdisciplinary research in the Department.*

*We have initiated a new campaign to connect with our alumni. I have had the pleasure of meeting several alumni and interacting with them in person or electronically. This is one of the more enjoyable tasks of being a chair. I invite all our alumni to visit the Department and campus, and also ask you to keep in touch with us through our website.*

*Welcome to an exciting new academic year!*

*- Sri Sridhar, Chair*

Images at top: left to right: Computer simulated dendritic crystal growth during the solidification of an undercooled melt; Common space at the newly renovated CCNR; Model for interband transition; Didier Casse, Researcher, characterizing negative-index metamaterials using near-field optical scanning microscope (NSOM).



Northeastern

# Physics Research Centers and Institutes Foster Interdisciplinary Research

Exciting research is carried out in four interdisciplinary research centers and institutes headed by Physics faculty. While they are primarily housed in the Department, these centers involve faculty from other departments and institutions.

## CIRCS

The Center for the Interdisciplinary Research on Complex Systems (CIRCS), directed by Professor Alain Karma, was started as a response to the present challenges to conduct quantitative interdisciplinary research on many important experimental and theoretical complex problems in biology and materials science. The typical approach of doing research that is characterized by explicit barriers between disciplines is not acceptable if one wants to find quantitative and relevant solutions to these types of problems. As quantitative model builders, members of CIRCS want to make important contributions in finding solutions to these problems by fostering direct collaboration and interaction between experts in different disciplines; in particular, those in biological physics and nanophysics. Members are drawn from several departments, including Physics, Mathematics, Chemistry, Biology, and Mechanical Engineering. Website: <http://www.circs.neu.edu>

## ASCC

The Advanced Scientific Computation Center (ASCC), directed by Professor Arun Bansil, was established in 1999 to provide specialized computational resources in research and education in computational

science and engineering at Northeastern University. The Center is comprised of 20 major departments, centers, and institutions at Northeastern and involves several hundred projects. It has helped researchers initiate, forge, and expand many new research collaborations within and outside Northeastern University. Through the ASCC, the University received a GAANN (Graduate Assistantships in Areas of National Need) Fellowship program from the Education Department. Within Physics, Chemistry, Biology, and Math, 40 PhD students were awarded GAANN fellowships. The ASCC has provided a powerful umbrella for leveraging University computational resources and putting together many interdisciplinary research and teaching programs. Website: <http://stardec.hpcc.neu.edu/>

## CCNR

The Center for Complex Network Research (CCNR), directed by Professor Laszlo Barabasi, has a simple objective: think networks. The Center's research focuses on how networks emerge, what they look like, and how they evolve, and how networks impact our understanding of complex systems. Past studies include the topology of the World Wide Web—showing that webpages are on average 19 clicks from each other; a complex cellular network inside the cell—looking at both metabolic and genetic networks; the Internet's Achilles' Heel. The Center's researchers have even ventured to study how actors are connected in Hollywood. CCNR is organized to have a heavy focus in collaboration: biological,

computer, and social scientists (to name a few), all working closely to investigate a diverse array connections between these many disciplines. Its Director, Professor Barabási is the recipient of the von Neumann Award for Computer Science and the FEBS Anniversary Prize for Systems Biology. He is also an elected member of the Hungarian National Academy and Academia Europaea. Website: [www.barabasilab.com](http://www.barabasilab.com)

## eMRI

The Electronic Materials Research Institute, directed by Professor Sri Sridhar, was established to synergize and catalyze research and education in materials for nano-, bio- and info-technologies. The Institute is interdisciplinary, comprised of faculty experts in a variety of areas of Materials Science and Engineering from the Colleges of Arts and Sciences, Engineering and Health Sciences. The main research thrusts of the Institute are nanomedicine, nanophotonics and renewable energy. eMRI achievements in fundamental and translational research include securing more than \$7.3M in external funding, collaborating with or servicing more than 30 faculty, 100 postdocs and students and over 20 external companies/medical/government research institutions. eMRI oversees the IGERT program in Nanomedicine Science and Technology, a \$3.5M training program funded by NSF and NCI. eMRI also manages the Nanomaterials Instrument Facility. Website: [www.emri.neu.edu](http://www.emri.neu.edu) ■

## Co-op 2007: Jesse Silverberg



During the last summer/fall co-op rotation, I had the good fortune to travel and work in India. Thanks to Prof. Menon, I was invited by the Department

of Theoretical Physics (DTP) at the Tata Institute of Fundamental Research (TIFR) for a 6 month “visiting student” program. Upon arrival, I was paired off with Vikram Tripathi, who would be my mentor and advisor during the stay. We initially discussed my existing undergraduate education and decided on a 10 week crash course specifically designed

to build upon existing foundations and expand into the realm of condensed matter.

In the last month I was also invited to attend the International Conference on Strongly Correlated Electron Systems held in Goa. During the 10 days of talks (56 in all), the topics ranged from quantum phase transitions to frustrated magnetism to Non-Fermi liquids.

Overall, the co-op was a highly educational and influential academic experience. Not only was I exposed to topics generally reserved for graduate students and professional researchers, but my plans for post-graduation were clarified. On a

more personal note, it became apparent that physics was the right choice; I'm very happy to have embarked on the academic adventure. ■



Religious art in Bangalore, India.

# Graduate Studies: Theoretical Elementary Particle Physics



Zuowei Liu came to Northeastern University in the summer of 2003 after obtaining a B.S. in Physics from Fudan University in Shanghai, China. He completed his dissertation in

August and will begin a Post Doctoral Fellowship at the C. N. Yang Institute for Theoretical Physics at Stony Brook University in the fall.

Zuowei has worked on several projects in the field of particle physics during his graduate years here under his advisor, Matthews Distinguished Professor Pran Nath, and in collaboration with fellow graduate student Daniel Feldman. One of them is a new class of models called the Stueckelberg extensions of the Standard Model which

could be remnants of the string theory. This work has drawn national attention in the press. See e.g., in the news section: [http://www.fnal.gov/pub/today/archive\\_2006/today06-07-27.html](http://www.fnal.gov/pub/today/archive_2006/today06-07-27.html), <http://www.azom.com/news.asp?newsID=6124>.

Another project on which Zuowei has worked under the guidance of Professor Nath and in collaboration with Daniel Feldman, concerns tests of supergravity unified models, leading candidates for physics beyond the Standard Model. These tests include the investigation of different hierarchical mass patterns which can be discovered at the Fermilab Tevatron in future experiments in CMS and in ATLAS at the CERN Large Hadron Collider (LHC) in Geneva, Switzerland. Because it is of great importance to understand what we are expecting to see at the LHC, this research has also attracted the attention of national



Professor Pran Nath in front of one of the dipoles that make up the Large Hadron Collider (LHC) which is located in CERN.

media, including MSNBC, FoxNews, and USA Today under the heading: *Smash! The Search for 'Sparticles'*. To read the article, visit [http://www.usatoday.com/tech/science/2008-01-28-large-hadron-collider\\_N.htm](http://www.usatoday.com/tech/science/2008-01-28-large-hadron-collider_N.htm). ■

## DEPARTMENT NOTA BENE

### New Appointment

Professor Lev Perelman joined Northeastern as a Professor of Physics in January 2008. He will also hold a joint appointment in Electrical and Computer Engineering.

### Promotions

Professor Emanuela Barberis was awarded tenure and promoted to Associate Professor.

Professor Sergey Kravchenko was promoted to Full Professor.

### In the News

An article written by members of the Barabási research group on the random trajectories of 100,000 anonymized mobile phone users was published in *Nature* and profiled on the cover. <http://www.barabasilab.com>

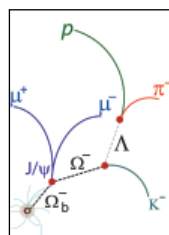


Nature 2008

Scientists at Fermilab have announced the observation of pairs of Z bosons, force-carrying particles produced in proton-antiproton collisions at the Tevatron, the world's highest-energy particle accelerator. Team members include NU Associate Professors Darien Wood and Emanuela Barberis, NU postdocs Gianluca Cerminara and Gavin Hesketh, and NU graduate student Gabriel Facini. Professor Wood is also co-leader of the DZero experiment. [http://www.fnal.gov/pub/presspass/press\\_releases/Dzero\\_zzdboson.html](http://www.fnal.gov/pub/presspass/press_releases/Dzero_zzdboson.html)

The same team also participated in the discovery of a "doubly strange" particle called the Omega-sub-b ( $\Omega_b$ ). Comprised of two strange quarks and

a bottom quark (s-s-b), the discovery brings scientists a step closer to understanding exactly how quarks form matter and to completing the "periodic table baryons." [http://www.fnal.gov/pub/presspass/press\\_releases/Dzero\\_Omega-sub-b.html](http://www.fnal.gov/pub/presspass/press_releases/Dzero_Omega-sub-b.html)

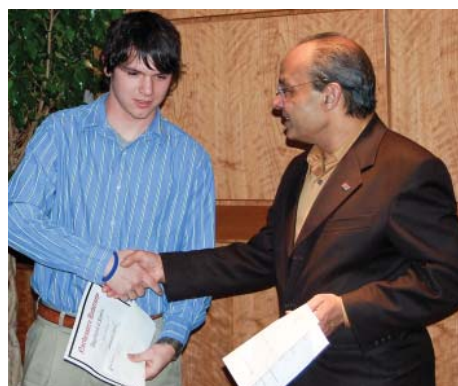


DZero Collaboration

Northeastern's eMRI team research, led by Professor Sri Sridhar, leads to a nanophonic breakthrough. The team includes researchers Wentao Lu, PhD, Bernard Didier Casse, PhD, and graduate student Yongjiang Huang. The findings were profiled in recent issues of *Nature* and published in *Applied Physics Letters*. <http://sagar.physics.neu.edu>

### Honors

College of Arts and Sciences Distinguished Professors Sri Sridhar and Alain Karma were



Thomas Nummy and Professor of Physics and Chair Sri Sridhar at the annual Lawrence Awards.

selected as Fellows of the American Physical Society last fall.

Professors Robert Markiewicz and Jeffrey Sokoloff were named Outstanding Referees at this year's American Physical Society (APS) meeting.

### Awards

Professor Alain Karma received the 2008 Bruce Chalmers Award. This is the highest award given by The Mineral, Metals & Society (TMS).

Associate Professor John Swain received an Honorable Mention in this year's Essay on Gravitation competition.

The 2008 Lawrence Awards were held at the Alumni Center on April 15. Congratulations to this year's winners.

### Graduate Excellence in Teaching

Kathy Chaurasiya  
Francisco Reynoso

### Graduate Academic Excellence

Wanzhe Feng  
Hao Wu  
Jinzhong Zhang

### Journal Club Speaker Award

Tarec Fares  
Thayaparan Paramanathan

### Undergraduate Scholastic Excellence

Thomas Nummy  
Garrett Stevens

### Undergraduate Research

Derrick Brittain

# Physics and the Community

Physics faculty continue to be extensively involved in educating the public on the importance of physics.

For the last seven years, EEP physicists at NEU (Professor Darien Wood, Associate Professor Emanuela Barberis, and now Associate Professor George Alverson) have worked with high school teachers throughout the Boston Area QuarkNet Center. The Center is run in collaboration with Boston University. Brandeis University is another recent collaborator. Summer QuarkNet workshops and quarterly meetings are scheduled with instructors and students in order to enhance the understanding of basic physics concepts.

This past spring the Department hosted the 2008 QuarkNet Masterclass at Northeastern.

Professor George Alverson led the day's activities in which high school students and teachers had the opportunity to analyze simulated data. This year's program concentrated on data expected to resemble data scheduled to arrive later this year from the Large Hadron Collider facility located near Geneva, Switzerland. Images from this QuarkNet Masterclass at Northeastern can be viewed at: [http://www.physics.neu.edu/quarknet/quarknet\\_2008.php](http://www.physics.neu.edu/quarknet/quarknet_2008.php).

Professor Tomasz Taylor continued his Theorynet outreach program during the past year, sponsoring scientists in visits to Boston-area high schools. He is currently organizing a Theorynet conference that will be held May 2009. ■



NU Professor George Alverson explains the Standard Model of the elementary particles and their interactions to visiting high school students at the QuarkNet Masterclass.

## CONGRATULATIONS TO OUR 2007/2008 PHYSICS DEGREE RECIPIENTS

### Doctor of Philosophy

Flaviu Gruia  
Advisor: Professor Paul Champion  
*"Low Frequency Dynamics of Heme Proteins and Heme Model Compounds Probed by Femtosecond Coherence Spectroscopy"*

Semih Gulzari  
Advisor: Professor John Swain  
*"Fractals in Quantum Electrodynamics"*

Hektor Kashuri  
Advisor: Professor Nathan Israeloff  
Professors Ronald Aaron and Carl Shiffman, Emeriti  
*"Anisotropy of Human Muscle via Non-Invasive Impedance Measurements. Frequency Dependence of the Impedance Changes During Isometric Contractions"*

Hsin Lin  
Advisor: Professor Arun Bansil  
*"Topics in Electronic Structure and Spectroscopy of Cuprates"*

Daniel Nissenbaum  
Advisor: Professor Arun Bansil  
*"The Stochastic Gradient Approximation: An Application to Li Nanoclusters"*

Hassan Oukris  
Advisor: Professor Nathan Israeloff  
*"Fluctuation Dissipation Relation and Scaling Behavior During Aging in Polymer Glasses"*

Leila Shokri  
Advisor: Professor Mark Williams  
*"Thermodynamics and Kinetics of DNA-Protein Interactions from Single Molecule Stretching"*

Zhen Wu  
Advisor: Professor Latika Menon  
*"Semiconductor Nanostructures: Synthesis, Properties and Device Applications"*

### Master of Science

Wanzhe Feng  
Darin La Sota  
Yang Liu  
Kai Zhang  
Yang Zhang

### Bachelor of Science

Matthew Bouchard  
Cory Fantasia  
Rezwan Ferdaus  
Kristen Flowers  
Daniel Gold  
Luca Holme  
Michael Jozsa  
Matthew Majewski  
James McNulty  
Jamie Mettenbrink  
J. Spencer Morris  
Suketu Patel  
Adam Roe

### Supporting the Department

The Physics Challenge is an opportunity to make a lasting contribution to the future of the Physics Department and the University.

Your support will provide scholarships to students, develop new physics programs, and contribute to new facilities and equipment.

Your support is essential to furthering our mission to provide our students with education and experiences that will help transform their lives.

For more information on how to give, please contact

Patricia Flint  
Associate Dean & Director,  
Development College of Arts & Sciences  
[p.flint@neu.edu](mailto:p.flint@neu.edu), or (617)373-7356

By Check:  
Make check payable to Northeastern University, Dept. of Physics  
360 Huntington Avenue  
111 Dana Research Center  
Boston, MA 02115

### Stay Connected, Stay Informed!

Our goal is to keep you connected and informed.

Tell us about your own professional accomplishments or personal updates. Please send news to us and we will include it in a new **Alumni Updates** column.

Do you have any suggestions for articles for upcoming issues?

Do you know of an alumnus who is not receiving our newsletter but would like to be on our mailing list?

### Contact Us:

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