Vol. 10

### Fall 2008

### A Note from the Chair

By Dr. Ravindra Pandey Professor and Chair

From learning "how clouds work, especially how they precipitate" to "bending, distorting, and ultimately slowing down light" to "mechanism behind the single molecular switch", our department is fully engaged in numerous innovative and exciting research projects. The on-going research activities have helped us provide a rich experience for undergraduates – sixteen undergraduate students have participated in senior research projects this year. The research activities have also resulted in training and development of other young educators and scientists who are pursuing their career in academy, industry and government laboratories after receiving MS and PhD degrees in Physics/Engineering Physics.

Profs. Gary Agin and Edward Nadgorny have decided to pursue other interests this year after having illustrative careers in research and teaching at Michigan Tech Two new faculty members have joined the department. Dr. Lee is exploring the physics of quantum entanglement and its applications, whereas Dr. Mazzoleni brings the expertise in studying aerosol optical properties and interactions with solar radiation, clouds and snow. An accompanying article gives the details of their research interests.

The website APOD—Astronomy Picture of the Day—created and managed by **Prof. Nemiroff** has become one of the most popular astronomy websites with approx. 3.5 million page views per week. It displays image or photograph of the universe every day. Please visit the website at http://antwrp.gsfc.nasa. gov/apod/astropix.html.

Your encouragement and support of the department is deeply appreciated. As you decide on end-of-the-year donations, please consider a contribution to the department's endowment for undergraduate and graduate students.

Best wishes for a joyous holiday season and a happy and prosperous New Year.



Physics News

### Current Research

JSICS Ne

Michigan Tech Physics Department Newsletter.

Kim Fook Lee Quantum Optics, Entanglement and Quantum Information



Dr. Kim Fook Lee is exploring the physics of quantum entanglement and its applications. His current research interest at Michigan Tech is to develop an entanglement source for quantum information processing and to invent a

biomedical-imaging technique based on quantum optics technology. Dr. Lee's most recent co-publication is "Demonstration of a Quantum Controlled-NOT Gate in the Telecommunications Band," in *Phys. Rev. Lett.* 100, 133603 (2008).



Kim Fook Lee joins us from Northwestern University as an assistant professor. He holds a PhD and an MA in Physics from Duke University. He has just received a Michigan Tech Century II Campaign Endowed Equipment Fund (C2E2) award for "Low-Noise, High-Speed Single Photon Detector."

Claudio Mazzoleni Anthropogenic and Natural Aerosols



Dr. Claudio Mazzoleni is interested in the effects that aerosols have on earth's climate and air quality. The research involves the analysis of data collected during in-situ measurements performed at different locations of the globe. Various

sites, from polluted urban areas to remote regions, are studied onboard aircraft or on the ground. Such atmospheric studies are necessary to develop aerosol parameterizations needed in numerical models for predicting future global changes with increased accuracy.

Claudio Mazzoleni was hired as an assistant professor within the Strategic Faculty Hiring Initiative in the theme of sustainability. He comes to Michigan Tech from Los Alamos National Lab. Mazzoleni holds a PhD in Atmospheric Sciences from the University of Reno, Nevada and a Laurea in Physics from the University of Trento, Italy. He also received a C2E2 award for "A Universal Infrared Detector for Interdisciplinary Research Applications."





## Ravindra Pandey

Michigan Tech Research Award

Professor of Physics and Chair Ravi Pandey is a recipient of the 2008 Research Award for his work on the theory of materials. Pandey's computational

modeling spans topics in crystals, nanoscale systems, devices, and the interaction between engineered materials and living tissue. His accomplishments include more than 100 publications cited over 1500 times, millions of dollars in research funding, successful problem-solving for Dow Corning and the Air Force, and a very productive term as department chair. Pandey's most recent research involves DNA sequencing, carbon and boron nanotubes, and AlN nanostructures and crystals. Co-researchers include a diverse, international team of condensed matter theory experts.



Graduate student Amalia Anderson presents "Analysis of Climatic Data via Statistics of Record-Breaking Extremes" to her advisor Alex Kostinski. She was awarded Best Poster Presentation during the departmental poster session in Spring 2008.



## David F. Nitz

Auger Inauguration Honor

Dr. David Nitz was honored by Argentine Governor Celso Alejandro Jaque for his contributions to the scientific advancement of the search for

the unknown sources of the highest energy cosmic rays. The ceremony took place during the inauguration of the Auger Observatory on November 14, 2008, in Malargüe, Argentina. Nitz was one of only a handful of scientists in the 450 member international collaboration to receive a personally inscribed silver plate from the governor.

The honor follows on the heels of a remarkable breakthrough last fall in establishing the anisotropic distribution of the highest energy cosmic rays. The collaboration published these important results as the cover story for Science magazine in November, 2007. The Pierre Auger Observatory began construction in 2000, and was inaugurated November 13-15, 2008.

Dr. David Nitz and Dr. Brian Fick have been involved in the Auger Observatory for 17 years, since the earliest conceptual ideas. During that period they have made key contributions to all phases of the project. These include measurements of atmospheric clarity that led to the selection of the Argentine site, the design and implementation of the triggering system for the Observatory, as well as important design concepts for the novel wireless data communications system.

# **New Facility**

Fisher Hall Lobby Observatory Astronomy Night Resumes in March!!

## Senior Research

#### Student

Martin Boluyt **Jamie Bougher Carrie Butler** Caleb Carlin Eric Conrad **Jake Deschaine** Matt Dunkman Nathan Hinkley **Curtis Hunt Brandon Johnson** Dan Kestner Leland Kruse **Derek Meyers** Steven Nerat **Paul Rojas** Sam Tootle

#### **Project Title** Determine Avogadro's Number from Brownian Motion Pursuit of the Hidden Valley Signature Boron Nitride and Carbon Nanotubes Modeling of Water Structure Near Alcohol Lattice Interface Horizontal Attenuation of UV Light Under Varying Weather Conditions **Cloud Physics Characterizing Exotic Showers** Modeling of Nanoparticle Catalysts for Singlet Delta Oxygen Production Study of Chaos Molecular Mechanics Of An Intelligent Molecule Photon Fluids and Condensates Alternative Fuels Enterprise **Boron Nitride Nanotubes** Simulation of Metal-Protein Binding Determine Avogadro's Number from Brownian Motion Automated Vision Maintenance System

Advisor **Raymond Shaw** Myron Campell Yoke Khin Yap **Caroline Taylor Brian Fick Raymond Shaw Brian Fick** Max Seel **Bryan Suits Ranjit** Pati Miguel Levy Jason Keith Yoke Khin Yap Max Seel **Raymond Shaw Bob Dejonge** 

Physics News

MichiganTech

## Department Updates

**Raymond Shaw** was promoted from associate professor with tenure to professor with tenure. **Brian Fick** has been promoted from associate professor without tenure to professor with tenure. **Ranjit Pati** was promoted from assistant professor without tenure to associate professor with tenure.

Kim Fook Lee and Claudio Mazzoleni have joined the department as assistant professors.

Manfred Fink, Dieter Gruen, Siegfried Hoefinger, Shashi Karna, Sung Lee, Massimo Moraldi, Frank Underdown, and John Vail have joined the department as adjunct faculty.

Professor Ulrich H. E. Hansmann has returned from his sabbatical in Jülich, Germany. Professor Raymond Shaw has returned from his sabbatical in Liepzig, Germany.

The department was visited by researchers Mrinalini Deshpande, David Groh, Neeraj Misra, Shishir Pandey, Alexei Podtelezhnikov, Manuel Recio, and Sarah Richards. Lin Pan has received her PhD at Michigan Tech and joined the department as a postdoc. Samuel B. Trickey presented a series of lectures on topics of density functional theory.

Max Seel has stepped down as the Dean of the College of Sciences and Arts after more than 18 years of service. He has rejoined the Department of Physics as a professor.

Gary Agin has retired and was awarded emeritus status. The department recently honored Presidential Professor Edward Nadgorny on his retirement.

Scott Rutterbush has joined the department as a lab associate.

Visit *phy.mtu.edu* to learn more about the many recent and past activities within the Physics Department. You will find an extensive News and Awards section under Features.



Left to Right: Gary Agin, Don Beck, Ed Nadgorny, and Jacek Borysow. Gary and Ed were each honored by their friends and colleagues at retirement dinner parties held at the Best Western Franklin Square Inn in Houghton. Recent Degree Recipients

### 2008

Eli Ochshorn, PhD Lin Pan, PhD Bijunath Patla, PhD Raghav Vanga, PhD Eric Domeier, MS Pavan Kumar Valavala, MS

Michael Aden, BS Douglas Banyai, BS Ben Coupland, BS Benjamin C. Gookin, BS Michael Gussert, BS Matt Hansen, BS Anthony Hegg, BS Jennifer Huyck, BS Stephanie Irish, BS Benjamin Meier, BS Victor Muzzin, BS Robert Niffenegger, BS Katie Thorne, BS

#### 2007

S. Gowtham, PhD Yanjie Wei, PhD Liang Han, MS Puspamitra Panigrahi, MS Shun Wu, MS Destination SUNY Potsdam Michigan Tech Harvard Corning Incorporated

Johns Hopkins University

Michigan Tech University of Michigan Colorado State University Colorado State University Purdue University University of Illinois

University of Chicago

Purdue University University of Notre Dame

AT&T (SBC) Research Princeton Michigan State Michigan Tech Kansas State University

The universe is full of magical things, patiently waiting for our wits to grow sharper. —Eden Phillpotts



## Molecular Switch

Last summer Associate Professor Ranjit Pati received an extraordinary amount of media attention for his model observations regarding the mechanism behind the single molecular switch. The ultra-tiny device was modeled quantum mechanically. An applied voltage showed a typical increase of current with voltage, until suddenly it dropped again, exhibiting a phenomenon known as negative differential resistance. The behavior has applications as a transistor,

or on/off switch. The mechanism was hailed as a "holy grail" of computing. The story was picked up by numerous online scitech magazines, such as redOrbit, NanoTechWire, Betterhumans, EnterTheGrid, and NSF News from the Field. The exposure quickly went abroad, where the story was revisited by Yahoo! India, Webindia123, CNews from Russia, and Semiconductor International.



MichiganTech

### Awards and Achievements

**Stephanie Irish** received the 2008 Ian W. Shepherd Award for most outstanding physics graduate.

Physics graduate student S. Gowtham received a \$2000 Finishing Award from the Michigan Tech Graduate School.

Physics Department Graduate Student Presentations: Best Oral Presentation Award went to Ewe-Wei Saw and Best Poster Presentation Award went to Amalia Anderson.

Emeritus Professor Gary Agin was recognized for 40 years of service to Michigan Tech.

Physics research occupied 5 articles of Michigan Tech Research Magazine for 2008, including faculty, graduate, and undergraduate work.

Yoke Khin Yap was elected chair of the user group of the Center for Nanophase Materials Sciences at Oak Ridge National Lab, editorial board member of *Research Letters in Nanotechnology*, and editorial board member of *Journal of Nanotechnology*.

### Thanks!

We extend our deepest appreciation to friends and alumni who have made recent gifts or pledges to Michigan Tech. Did we miss your contribution? If so, contact physics@mtu. edu. As always, we appreciate your continued interest in the Department of Physics at Michigan Technological University.

#### Alumni

Ramakrishnan Bashyam '96 George L. Bennis '88 Nathanael D. Black '03 Thomas L. Brayak '70 John C. Bretney '69 Robert L. Brooke '57 David O. Carlson '64 Russell A. Compton '63 Marvin J. Cox '64 Pamela A. Croy '66 Matthew W. Davenport '06 Adam J. DeConinck '07 Andrew R. Drews '84 Eric W. Duffin '83 John B. Eisenlord P.E. '52 John P. Evans '50 James C. Gekas '68 Thomas H. Gould, Jr. '63 Joel H. Graber '87 Roland C. Hanson '55 Frank R. Hastedt '58 Dean M. Herr '78 Thomas H. Hintz '92 Bradley D. Irwin '86

Philip E. Kaldon '88 Paul R. Kaptur '76 James J. Kaufman '67 Walter E. Kauppila '64 Wayne M. Keranen '97 Lloyd W. Klusendorf '67 Norman H. Larsen '61 Robert W. Lind '61 Robert C. Mania Jr '74 Dennis M. McCal '74 Charles J. McEwan '74 Ronald A. Meyer '64 Jeffrey Allen Morris '84 David M. Ng '67 Patrick J. Northrop '84 Samuel S. Ochodnicky '63 Gary M. Palmgren '76 Thomas M. Plutchak '69 Allen E. Pudvan '57 Mary J. Repar '75 Gary E. Rhoney '65 Joseph L. Roti Roti '65 Suresh K. Sampath '98 Mark S. Schmalz '74

## Senior Spotlight

#### Jamie Bougher



Jamie Bougher is a senior physics major, with a minor in math and another minor in French. In spring of 2008, she was the recipient of the Departmental Scholar Award and the Woman of Promise Award. She has also received multiple merit awards from the Department of Mathematical Sciences.

Bougher is active in the Society of Physics Students. She attended the 2008 Quadrennial Sigma Pi Sigma Congress, she is a founding member of the university's Honors Institute, and she became president of the Technobabe Times student newsletter. Jamie has done research in Dr. Levy's lab and participated in Research Experience for Undergraduates, analyzing data from the Collider Detector at Fermilab. She has worked as a Resident Assistant and is now a Teaching Assistant for physics as well as a monitor in the Modern Language Lab for humanities.

Jamie is continuing her senior research at the University of Michigan. She intends to go to graduate school to study experimental high energy particle physics, hoping to participate in the BaBar collaboration through the University of Louisville in Kentucky. Her long term goals include working as a professor at a university and a science advisor in government.

> Christopher T. Schmidt '90 James R. Strobel '74 Amin Sutjianto '95 Donald J. Szenina '73 Glen J. Tauke '72 John B. Taylor III '59 Roger L. Urbaniak '66 William J. Wilson '78 Jerry D. Winegarden '79 Helmut Winter '70 Larry C. Wittenbach '61 David M. Wiiteveen '88 William E. Wuerthele '66 Robert C. Yoder '67 Gary B. Zulauf '72

#### Friends

Keith M. Baldwin John A. Jaszczak Alfred N. Joyal Ronald M. Kruse David F. Nitz Kathleen S. Wollan



## Staff Spotlight

#### Mike Meyer

Lecturer and lab coordinator Mike Meyer has taught algebrabased introductory physics courses and managed introductory physics labs for over 1000 students each semester at Michigan Tech since 2003. In a typical semester, he schedules TAs for and oversees more than 40 sections of 4-6 different lab courses. Prior to working at Michigan Tech, he was an information technology trainer for Marshfield Clinic, training medical staff on patient care and business systems both online and in person. His focus has therefore been to bring a variety of technologies into his labs and introductory courses to improve pedagogy, student engagement, and administration.



Over the past four years, Meyer has developed systems for introductory labs that automatically randomize seating, check student learning, identify students with attendance or grade trouble, and allow students to evaluate the labs to drive continuous improvement. He's also recorded pre-lab videos, created selfguided PowerPoint presentations, and provided online pre-lab quizzes and other online resources (including

simulations) to provide a rich pre-lab experience. These changes, along with some differences in recruiting and training lab teaching assistants, has led to a dramatic increase in student satisfaction with the labs. "I am an avid rock collector and belong to the local Copper Country Rock and Mineral Club, I have held many offices in the past and am still very active. I am also involved with the Seaman Mineral Museum Society Board and help plan and run the annual ball fundraiser for the museum." -mm

### Humboldt Fellow

Professor Raymond Shaw spent the 2007-08 year in Leipzig, Germany as a Research Fellow of the Alexander von Humboldt Society. He worked with colleagues at the Leibniz Institute for Tropospheric Research in two areas of research. The first area involved studies of ice nucleation in the Leipzig Aerosol-Cloud Interaction Simulator, an 8-meter-long laboratory chamber for studying the transformation of aerosol particles to cloud particles. The second research area involved studies of turbulence in clouds using the Airborne Cloud Turbulence Observation System, an instrumented platform suspended 150 meters below a helicopter. It is pulled through clouds at a low enough speed that very high resolution measurements of thermodynamic, fluid-dynamic, and cloud-microphysical properties can be made. Two field projects, in Kiel, Germany, and in Cabauw, Netherlands, were carried out, the latter as part of a European Union project to study the influence of clouds and aerosols on climate change.

## Graduate Spotlight

### Haiying He



"I came to US in the fall of 2003 and joined Professor Ravindra Pandey's research group for my Ph. D degree in Computational Solid State Theory and Materials Science at Michigan Tech. This has been a very important step both in my career and in my life, after receiving the Master's Degree and continuing to work for three years in experimental

Materials Science at Lanzhou University, China. The novel phenomena observed in nanomaterials at that time enthused me to pursue a further systematic study to strengthen my theoretical background for a better understanding of the underlying physics behind the phenomena. And it has turned out to be a very fruitful experience for me at Michigan Tech." -bh

Haiying feels she has received a rigorous training in physics. Her research involves computational approaches ranging from atomistic simulations to first-principles calculations in topics of nanoscale materials and nano/molecular electronic devices. She is a mother of three who juggles family and school responsibilities while enjoying the beautiful scenery and seasonal activities of the area.

## Serendipity Science

Ravi Pandey was trying to determine if carbon nanotubes could be a weapon in the fight against cancer when he discovered something quirky about DNA that could revolutionize genesequencing technology. Pandey, S. Gowtham, and Ralph Scheicher investigated whether carbon nanotubes would react with constitutent bases of DNA. If too reactive, the nanotubes would be useless as targeted drug-delivery systems. The group discovered a low polarizability of base pairs in the presence of the carbon nanotubes, indicating low binding.

Not only did this show the promise of nanotubes as tiny vehicles for drugs, but it also suggested that slight changes in polarizability varying across the base pairs could be used as a sequence indicator. Drawing a DNA strand through a nanotube membrane with an electric current in place would allow measurement of a voltage signal, identifying the base pair sequence. The group is working with Lanrong Bi in the chemistry department to develop a prototype of their model.

This is only possible because the scale of materials has gone down to the nano-level. We're using quantum mechanics to understand biological processes. It's the fusion of biology and physics, a whole new world. —Ravi Pandey

Physics News



5



Physics News Michigan Technological University 1400 Townsend Drive Houghton, Michigan 49931-1295 Non-Profit Organization U.S. POSTAGE PAID Permit No. 11 Houghton, Michigan 49931

## Michigan Tech Physics Alumni - Get Listed On Our Website

We would like to stay in touch. Please include ONLY information below you wish to have publicly posted at **phy.mtu.edu**. Any other information you may submit by logging in to Michigan Tech Huskylink at **huskylink.mtu.edu**.

Name	Degree and Year
Current Position/Employer	
Address	
Phone	Email
Website	
Other Information	

Feel free to attach information or to email us information at any time to physics@mtu.edu. Indicate clearly that you wish to have your information posted on our website. If you would like to make a donation to the Physics Department, please make checks payable to the Michigan Tech Fund - Department of Physics. You can return this form and your donation to:

Physics Department, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295