

A Note from the Chair

By Professor Ravindra Pandey

In recent years, we have put a greater emphasis on increasing diversity in the department as a part of Michigan Tech's strategic plan. Specifically, the recruitment of Associate Professor Petra Huentemeyer as a faculty member has helped us in providing a role model for female students in physics. Petra initiated a biweekly lunch meeting with students, which led to the formation of the Society of Women in Physics student organization. Also, the department was recognized by the American Physical Society as one of the departments that has awarded the highest percentages of PhDs in physics to women between 2010 and 2012. This is a well-deserved recognition of the physics faculty members who are committed to diversity at Michigan Tech.

Physics alumnus Mike Larsen '01 has found further evidence for super-terminal raindrops (DOI: 10.1002/2014GL061397), which often surpass what appears to be the speed limit for rain. "Searching the Internet for Evidence of Time Travelers" was the topic of a fun-but-serious effort by Teresa Wilson and Professor Robert Nemiroff. The search strategy using terms relating Pope Francis and Comet ISON (arxiv.org/abs/1312.7128) was highlighted by a number of national and international media organizations.

Jae Suh joined the department as an assistant professor to strengthen our program in optical physics. Congratulations to Petra Huentemeyer on her promotion to associate professor. She is one of the key members of the High Altitude Water Cherenkov Observatory (HAWC) and has made a substantial contribution to research and teaching activities since joining the department in 2009.

This year, Marg Rohrer and Kathy Wollan have chosen to retire. We want to thank them for their contributions at the physics department front office and wish them all the best in retirement. They will pursue their interests in traveling, reading, and playing with grandchildren in this golden phase of life.

We will miss former faculty members Keith Baldwin and Robert Mount. Keith joined the Michigan College of Mining and Technology as an associate professor of physics in 1963, becoming an in-house expert in electronics. Bob came to Michigan Tech in 1954 and was popular with students in the introductory physics courses. Both of them had long and distinguished careers at Michigan Tech.

Many of these achievements have been made possible only with your encouragement and support of the department. As you decide on endof-the-year donations, please consider a contribution to the department's endowment. Your continued support is deeply appreciated.

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

Current Research

Jae Yong Suh



Jae Yong Suh has joined the physics faculty as an assistant professor. He earned his PhD in experimental condensed matter and applied optical physics at Vanderbilt University in Nashville. His research at Vanderbilt primarily focused on controlling the optical properties of metal oxides by changing the size and phase state of the materials. Suh held a postdoctoral fellowship at Northwestern University in Evanston, Illinois, where he published a number of papers in the areas of nanophotonics and plasmonics, including nonlinear processes and lasing in metal nanostructures. Prior to coming to Michigan Tech, he worked as a research engineer at LG, broadening his practical knowledge at an industrial site.

As part of the effort to explore quantum mechanical properties at the nanometer scale, Suh has proposed a metal-insulator-metal (MIM) nanostructure that supports a coherent, strong coupling of quantum emitters to a plasmon field below the diffraction limit; his work in this area currently involves fabricating MIM structures. Suh's research interests also lie in the manipulation of Nitrogen-Vacancy (NV) centers in diamonds, focusing on employing nanofabrication techniques to investigate their nonlinear optical properties.



Office assistants Kathy Wollan (left) and Marg Rohrer (right) celebrated their retirements this year.





Research with Impact

In 2013-14, researchers in physics investigated topics including the nature of rain droplets, the computational modeling of graphene, and even the existence of time travelers, all of which have received attention from the media and national publications.



Atmospheric Science: **Raymond Shaw** and **Alex Kostinski** have verified that smaller droplets in a rainstorm surpass what may be thought of as their terminal velocity. *Science Magazine* followed the story from 2009 to 2014.



Nanoscience: **Ravi Pandey**'s group has found that DNA nucleobases exhibit significantly different interaction strengths when physisorbed onto carbon nanostructures. The stabilizing factor appears to be dominated by the molecular polarization that induces a weakly attractive dispersion force between them. The research paper published in *Physical Review B* with the graduate student **Gowtham S.** has been cited about 133 times since it was published in 2007.



Internet: **Robert Nemiroff** and **Teresa Wilson** performed Google and social media searches for time travelers, which got the attention of several popular news outlets and garnered much public response.

Superior Computing

Director of Research Computing Gowtham S. was interviewed by *insideHPC* on the use of Michigan Tech's new supercomputer, "Superior." The machine is designed with an overall computing capacity of 31 TFLOPS CPU and 13 TFLOPS GPU. Research faculty in physics have taken advantage of this computing power.







Johana Chirinos is involved with a group that generated a fully simulated high-energy cosmic-ray shower, which required following the paths and interactions of millions of particles. The modeling work is part of the international Pierre Auger Project.

Kamal Dhungana and Ranjit Pati are designing a spinfilter device based on boron nitride nanotube quantum dots. They use first principles computational modeling to predict and compare the relative conductance of pristine and fluorinated systems.

Computational Solid The State Theory and Materials Science group, headed by Ravi Pandey, studies nanostructured materials for electronics, biosensing, and human health implications. A recent density functional theoretical method involved the electronic transport properties of the cubic quantum dot, (PbS)32.



The Physics Graduate Poster Session was held on April 17. Five graduate students presented posters in the Fisher Atrium. Left to right: Joseph Niehaus, Ran Duan, Ajaree Mongkolsittisilp, Jie Li, and Bishnu Tiwari.





Awards and Achievements

Recent Degree Recipients

Yoke Khin Yap Named Faculty Fellow

Professor Yoke Khin Yap has been selected for the newly implemented Faculty Fellow Program, administered by the Office of the Vice President for Research. As the 2014-15 Faculty Fellow in Economic Development and Technology Commercialization, Yap will be involved in areas such as intellectual property commercialization and start-up support.

Robert Nemiroff Receives Advanced Imaging Conference Hubble Award

Professor Robert Nemiroff is a co-recipient of the 2013 Advanced Imaging Conference Hubble Award. The award is given for continued support and ongoing advancement of the astrophotography community. Nemiroff and award co-recipient Jerry Bonnell, of the Compton Gamma Ray Observatory Science Support Center, were recognized for their pioneering online project, "Astronomy Picture of the Day," featured on NASA's website at http://apod.nasa.gov.

2014 Physics Graduate Student Awards

Atmospheric Sciences graduate student **Colin Gurganus** has received a Doctoral Finishing Fellowship for spring 2014. Physics graduate student **Amanda Shaw** has received an Outstanding Graduate Student Teaching Award. Engineering Physics graduate student **Ashim Chakravarty** was selected for the Dean's Award for Outstanding Scholarship.

Students Honored at Departmental Poster Session

The departmental poster session was held on April 17. The following students were recognized for their exemplary work:

- Joseph Niehaus and Ran Duan—Best Posters
- Hao Zhou and Hugo Ayala Solares—Best Research Talks

Michigan Tech's Society of Physics Students Named Outstanding Chapter

For the fourth year in a row, the Michigan Tech chapter of the Society of Physics Students (SPS) was selected as one of the Outstanding SPS Chapters. Selection criteria include such activities as chapter involvement in professional meetings and outreach efforts.

Among their activities this year was a fun-filled day at the 15th Annual Western Upper Peninsula Science Fair and Festival. The SPS students helped facilitate activities and engage youngsters in physics demonstrations.

In March, physics major and SPS chapter president Joe Charnawskas went to Washington, DC, to attend the 2014 Science-Engineering-Technology Congressional Visits Day. The students representing SPS from across the country attended talks and workshops on budgeting and funding. They had the opportunity to meet with the staff members of several senators and representatives. The event is intended to raise awareness of the importance of science and technology in our nation's future.

2014

Swarup China, PhD Colin Gurganus, MS Renee Gurganus, MS Chunhui Liu, PhD Yong Meng Sua, PhD

Xinxin Woodward, MS Michael Adler, BS Joseph Charnawskas, BS Stephen Dipple, BS

Greg Furlich, BS Sawyer Hopkins, BS Darcy Jacobson, BS Emily Makoutz, BS Brent Nicklas, BS

2013

Ravi Joshi, MS Ajaree Mongkolsittisilp, MS Madhusudan Savaikar, PhD Destination

Michigan Tech Michigan Tech Michigan Tech Valparaiso University University of Malaya, Kuala Lumpur Wayne State University Ohio State University Stony Brook University Rensselaer Polytechnic Institute University of Utah University of Kansas Lawrence Livermore Lab Colorado School of Mines Michigan Tech

Cummins, India Kasetsart University, Thailand South Dakota School of Mines and Technology

Michael Adler Honored with 2014 Ian Shepherd Award

Michael Adler is the recipient of the 2014 Ian W. Shepherd award, presented to the most outstanding graduating senior in physics. Applied Physics major Michael Small was a candidate for the Provost's Award for Scholarship, having been named the Departmental Scholar in Physics.



Senior Michael Adler (right) accepts the Ian Shepherd Award from 1995 alumnus Jason LaCosse (left).





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Recent Funding

Graduate Spotlight

Tolga Yapici

Two Physics Faculty Receive REF Awards

The Vice President for Research Office has announced the 2015 Research Excellence Fund awards. Associate Professor Will Cantrell was awarded an Infrastructure Enhancement Grant (REF-IE), and Professor Yoke Khin Yap will receive a Technology Commercialization Grant (REF-TC).

The REF-IE grant funded a single-particle soot photometer. This instrument can detect and quantify soot particles on a single-particle basis, which will enhance the research capabilities of such facilities as the Cloud Chamber and Pico Mountain Observatory.

The REF-TC grant was awarded for the project "New Fluorophore Carriers for Biomedical Applications," which will complement the work of Yap's research team that is funded by the National Science Foundation. The title of the NSF-funded project is "I-Corps: High Brightness Fluorescence Reagents for Biomedical Applications." Members of Yap's team include **Senior Research Scientist Dongyan Zhang** and **Research Associate Nazmiye Yapici**. REF-TC will help to identify business opportunities related to their technology in emerging areas of biomedical research.

New NSF-Funded TEM Microscope Coming to Campus

Physics faculty have had a hand in the acquisition of a new highresolution transmission electron microscope for in-situ microscopy research and education. This campus instrument will be funded by the National Science Foundation.

Physics Undergraduates Win 2014 SURF Awards

Applied Physics major **Robert Innis** and Physics major **Adam Laxo** received Summer Undergraduate Research Fellowships for 2014.



Tolga Yapici is a PhD student in the physics department, working under the supervision of Professor Brian Fick. He joined Michigan Tech in fall 2008, after finishing his master's degree in aerospace engineering at the Middle East Technical University. His research interests lie in high-energy particle physics and detector development. Yapici's current research has included analyzing data from the Pierre Auger Observatory and Monte-Carlo simulations; these projects are

aimed at uncovering the total cross-section and composition of the cosmic rays using advanced data analysis techniques, such as artificial neural networks. His work has also investigated the long-term performance of the Pierre Auger Observatory with GEANT4 (GEometry ANd Tracking) simulations. In addition, he contributed to the development of the communication system (electronic and software) for the Research and Development Array of the Pierre Auger Observatory site built in Lamar, Colorado.

Yapici expresses gratitude for the support and encouragement provided by his academic advisor, Fick, and for the support and training in electronics provided by Professor David Nitz. He acknowledges the Department of Energy and the Department of Physics for financial support. His long-term goal is to pursue a career in academia.

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.

- Gary P. Agin Alice Allen Edward Augustyniak '94 & Monika Sujczynska Wilma & Keith (dec) Baldwin Ramakrishnan Bashyam '96 & Harini Sampathkumar Stephen '02 & Jaime Beranek Robert P. Brammer John '69 & Louise Bretney David '64 & Mary Carlson Russell '63 & Joan Compton Pamela '66 & Floyd Croy Matthew '06 & Cassandra Davenport Delight '58 & John Deane Andrew Drews '84 & Sue Inderhees Eric '83 & Kari Duffin Thomas '63 & Judith Essig John '50 & Eugenia Evans
- Walter '48 & Edith Gabriel James '68 & Lynne Gekas Thomas '63 & Dona Gould Ioel H. Graber '87 Frank '58 & Shirley Hastedt S. J. Jablinske Stanley'70 & Christine Jefferson Joe '60 & Ann Jenney Philip Kaldon '88 & Deborah Morrow James '59 & Carole Kauppila Walter '64 & Margaret Kauppila Peter A. Kiefer '02 Ryan C. King'08 James '66 & Kathleen Kortge Joyce & Arne '52 (dec) Koskela Carmela Koussis Thomas '84 & Renee Kugler Jack '62 & Kaethe Labo
- Samuel C. Lambert '62 Edward M. Leonard '12 Miguel & Anita Levy Robert '61 & Eugenia '64 Lind Jennifer M. MacDonald David '61 & Terri McLaughlin Paul '71 & Joanne Michaels Daniel J. Miller '11 Jeffrey '84 & Suzanne Morris Charles Morris Edward & Nina Nadgorny Robert & Holly Nemiroff David Nitz & Mary Marchaterre Samuel '63 & Brenda Ochodnicky Donald '84 & Ann '86 Parry Harold W. Paul '75 Raman Pfaff '87

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Senior Spotlight

Michael Small

Staff Spotlight

Dennis Niedermeier and David Ciochetto



Michael Small is a fifth-year applied physics major, with an application area in material science and a minor in nanoscale science and engineering. In 2013, he was awarded a Summer Undergraduate Research Fellowship at Michigan Tech; during the fellowship, he began studying the applications of nanomaterials in photovoltaic cells with **Professor Yoke Khin Yap**, whom he continues to conduct research alongside. Small also began working at

the Michigan Tech Applied Chemical and Morphological Analysis Laboratory (ACMAL) last year, where he continues to operate scanning electron microscopes for campus research groups as the senior lab assistant. In addition, he currently serves as a teaching assistant for the Intro to Scanning Electron Microscopy Lab (MY 4201). Small's honors include being named the Department of Physics Departmental Scholar and a candidate for the Provost's Award for Scholarship. After graduation, he plans to pursue a PhD in Applied Physics and aims to study solid-state physics and nanotechnology. Small is very thankful for the support of his friends, family and mentors for seeing him to where he is today.

In Memoriam

Keith M. Baldwin, 85, passed away on Jan. 16 at Marquette General Hospital. He was born on May 25, 1928, in Buffalo, New York. Baldwin joined the Michigan College of Mining and Technology in 1963 as an associate professor of physics. His interests included electronics, radio repair, and vehicle testing. In 1984, he retired from Michigan Tech to form KMB/Tech. Baldwin was involved with the Kiwanis Club and Sea Explorers and participated in many volunteer activities throughout his lifetime.

Professor Emeritus Robert H. "Bob" Mount, a longtime member of the physics faculty, passed away July 2 at his home in Hancock. He was 86 years old. Mount came to Michigan Tech in 1954 from Cleveland-Cliffs Iron Company, where he was employed as the chief geologist. He retired from the University in 2000. For much of his career, he taught introductory physics courses. "His forty-six years of service is the second-longest in department history—the longest being James Fisher," said Professor Bryan Suits. Mount enjoyed physical fitness activities and caring for shelter dogs. New research staff members **David Ciochetto** and **Dennis Niedermeier** have joined the department to study cloud microphysical properties with the recently acquired Cloud Chamber (NSF MRI).

Ciochetto has pursued a career in experimental fluid dynamics beginning with AeroAstro Engineering, progressing through aero/ocean engineering to physical oceanography. His interest in fluid turbulence has spanned a range of scales, from wind tunnels to the world's oceans. He was involved in solving the problem of the missing ocean mixing and the first direct microstructure measurements in Drake Passage.

From measurements to modeling to instrument development, Ciochetto is proud to be participating in Michigan Tech's bold new adventure with the Cloud Chamber.

Niedermeier was awarded a Feodor Lynen research fellowship from the Alexander von Humboldt Foundation in Germany to work with the Cloud Chamber at Michigan Tech. His journey into atmospheric sciences began at the University of Leipzig/ TROPOS in Germany. His research interests involve atmospheric aerosol-cloud interactions and how these processes are influenced by turbulence. He brings to the group the ability to generate a variety of specific aerosol particles to form clouds, as well as a keen interest in the new facility.



Dennis Niedermeier (left) and David Ciochetto (right) examine Michigan Tech's new Cloud Chamber instrument.

Thomas '69 & Sharon Plutchak Kusum & V.R. (dec) Potnis Anonymous Mary J. Repar '75 Jeremy D. Rogers '99 William '66 & Dorothy Roth Joseph Roti Roti '65 & Stephanie Pagano (dec) Forrest & Tami Schimler

Maximilian & Mary Ann Seel James '63 & Janice Strahl James '74 & Karen Strobel Donald '73 & Carolyn Szenina Glen J. Tauke '72 Michael '64 & Mary Ellen Teneyck Roger '66 & Linda Urbaniak Anton '60 & Karin Usowski SriramaSwaminat Venkataraman '98 & Kalpana Chandrasekharan William '78 & Kathleen '77 Wilson David E. Woon '84 William E. Wuerthele '66 Charles '66 & Mary Zeigler





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Michigan Tech physics faculty and staff (right to left: Will Cantrell, Claudio Mazzoleni, David Ciochetto, Raymond Shaw) discuss the Cloud Chamber with Jim Bench (farthest left) from Russells Technical Products. The photo is taken from inside the chamber, showing the electropolished thermal control panels and, behind the scientists, the open door.