

A Note from the Chair

By Dr. Ravindra Pandey
Professor and Chair

“Space time may be less like beer and more like sipping whiskey.” This was suggested by Prof. Nemiroff after studying the tracings of three photons of differing wavelengths. The photons originated about 7 billion light years away from Earth from a gamma-ray burst and arrived at the orbiting telescope just one millisecond apart, in a virtual tie. This study published in *Physical Review Letters* could put limitations on theories of quantum gravity.

Prof. Mazzoleni and his research group climbed Mt. Pico in the Azores to study pollutants drifting east from North America. The results of this study will help in understanding the role of aerosols (tiny particles and droplets suspended in the atmosphere) in climate change by characterizing how much sunlight the aerosols are reflecting or absorbing and how their reflective properties change as they drift across the Atlantic.

On the nanotechnology front, the carbon nanotube-coated filter developed by Profs. Yap and Drelich is found to separate water and oil; the filter is about the size of a quarter and could be used for purification and recovery processes. Images of ZnO nanotubes grown in Prof. Yap’s laboratory were highlighted on the website of *Applied Physics Letters*.

We will miss Prof. Vasant Potnis who sadly passed away this fall. He had a long and distinguished career at Michigan Tech. He was a Fellow of American Physical Society in recognition of his work on low-energy nuclear physics.

In order to provide core physics principles for students pursuing other scholarly interests (e.g. business, medicine or law school), we have implemented a Bachelor of Arts in Physics option. It will also address the need for more high school physics teachers via a concentration in Secondary Education.

We are proud of our colleagues who are the recipients of this year’s University awards. Prof. Nemiroff has received the Michigan Tech Research Award, and Prof. Cantrell has received the Distinguished Teaching Award.

Many of these achievements have been possible only with your encouragement and support of the department. As you decide on end-of-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.*

Faculty Spotlight

Bryan Suits



What do acoustic refrigerators, chaotic pendulums, mufflers, and carbon dating have in common? Why, music, of course. At least according to Prof. Bryan Suits. All of these and more are included in his course “The Physics Behind Music.” The course was originally developed by Prof. Suits to combine his own interests in Physics and Music, and at the same time provide a general course for those on campus who may

only take one physics course during their Michigan Tech career.

According to Suits, “music is used as a motivator and central theme for the class, but we often stray into other areas with similar physics.” As an example, carbon dating, signal loss in cables, and the computation of the frequencies of notes on a keyboard are all used as examples of exponential processes. Suits is currently working on a text to accompany the course. “I thought it was ok without a text,” he says, “but many of the students have been asking for one.”

The course is demonstration intensive and Suits has designed and built, with help from the department machinist Jesse Nordeng, many new demonstrations for use with the course. One of his favorites is a one-string electric guitar, one meter long of course, which demonstrates the essential features of an electric guitar from a physicist’s point of view. Another is a Rijke tube organ, where tones are produced by small heaters.

Suits has been at Michigan Tech for over 25 years and is an expert in solid state nuclear magnetic resonance (NMR), most recently to aid in the search for landmines and other explosive materials. Now, as a result of work on his text, he has also started looking into the area of pitch perception. According to Suits, “Pitch perception by humans is an amazing process and includes both the physical properties of the ear and the neural processing by the brain. Unfortunately, it is not clear where one leaves off and the other takes over. For every explanation of how pitch perception works, there is a counter example which is left unexplained.”

More information about this course and some information about the physics of music can be found via the “other interests” link on his faculty web page.

Research in the News

Physics research stories were picked up in several popular and scientific news outlets. Some of the top stories originating from Michigan Tech in 2011-2012 involved astroparticles and nanotubes.



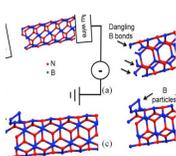
Auroras: Bob Nemiroff talked about the origin of the northern lights and their relationship with the Sun. This *Michigan Tech News* story was followed by *Great Lakes IT Report*, *Science Daily*, and *Phys.org*.



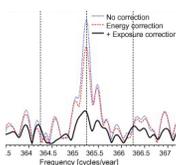
Gamma-Ray Bursts: Science media outlets *Great Lakes IT Report*, *World Science*, *Science Codex*, *Science*, *The National*, *Gizmag*, and *Air & Space Smithsonian* were all interested in Bob Nemiroff's research on the smoothness of the universe. The analysis was based on a race between photons.



ZnO Nanotubes: Yoke Khin Yap's nanotubes made the cover of *Applied Physics Letters* as part of its 50th anniversary celebration. Yap's article on the formation of ZnO nanotubes had been noted as one of the most read articles.



BNNTs: *NanotechWeb* featured work on boron nitride nanotubes conducted by Hessam Ghassemi and Reza Yassar in the mechanical engineering-engineering mechanics dept. and Chee Hui Lee and Yoke Khin Yap in the physics dept. These materials exhibit novel electrical properties as a function of mechanical deformation.



Auger Research: The journal *Astroparticle Physics* listed its "Top 25 Hottest Articles" for the 2011 year. Pierre Auger Observatory researchers David Nitz and Brian Fick are each co-authors of six of those articles, including the number one article on cosmic ray detection.



Team Fiziks won the championship again for 2012 in the Michigan Tech Graduate Softball League.

Department Updates

Ramy El-Ganainy was hired as an assistant professor. He comes from the University of Toronto, specializing in the area of photonics/nano-photonics structures. Ramy will join physics faculty after a one-year postdoctoral appointment at the Max Planck Institute in Germany.

Mike Meyer has been appointed the new director for the Center for Teaching and Learning. In Provost Max Seel's words, "The selection was based on what must currently be the priority for the campus: the urgency and necessity of adopting technologies and other approaches to enhance teaching and active learning through blended learning techniques. This is also expected by many students. Mike Meyer is the person to provide urgent and enthusiastic motivation toward that end." He remains a Senior Lecturer with the physics department.

Jacek Borysow was on sabbatical leave during the 2011 fall semester, collaborating with colleagues at the University of Texas-Austin, and in Italy and India.

Kelken Chang and Michelle Hui are new postdocs. Dustin Winslow joined physics as a temporary instructor/research assistant.

William Slough was hired as interim lab coordinator.

Sanjeev Gupta has joined Ravi Pandey's group as a Fulbright scholar.



The Physics Graduate Poster Session was held on April 19, 2012, in the Fisher Atrium. Six students presented research posters.

The Department of Physics has a new website:
www.mtu.edu/physics

Recent Funding

Research sponsors over the last year for the Department of Physics include NSF, NASA, the University of California-Los Angeles, DOD-AFRL, SURF, MSGC, and the Biotechnology Research Center at Michigan Tech.

Awards and Achievements

Marg Rohrer was recognized by Staff Council for 10 years of service to Michigan Tech.

Engineering Physics graduate student Pradeep Kumar is a recipient of the Dean's Award for Outstanding Scholarship in fall 2012.

Graduate students Xiaoliang Zhong and Pradeep Kumar have been offered Finishing Fellowships from the Michigan Tech Graduate School. Subhasish Mandal and Saikat Mukhopadhyay received Finishing Fellowships for 2012. Neluka Dissanayake was a Finishing Fellowship recipient for fall 2011.

Physics graduate student Matt Beals received a NASA Earth and Space Science Fellowship.

At the departmental poster session, the best oral presentations were given by graduate students Douglas Banyai and Nathan Kelley-Hoskins. The best poster presentations were given by Swarup China and Matthew Beals.

The Michigan Tech chapter of the Society of Physics Students (SPS) has been selected as one of the 2011 Outstanding SPS Chapters, the second year in a row for this distinction.

Greg Lau and Peter Solfest were co-recipients of the 2012 Ian W. Shepherd Award for most outstanding physics graduates.

Henes Gift



During the summer of 2012 infrastructural improvements were made to physics' research labs, thanks to a generous gift from Richard and Elizabeth Henes. Of particular concern was the ensurance of clean water, adequate temperature and humidity control, as well as a reduction of the dust content in the air. Safe use and storage of chemicals,

emergency eye washes, laser warning signs, and other safety-related issues were addressed where needed. Since the labs have all been repurposed from their original design, and many of the cabinets and countertops were in very poor shape, most labs received at least some updated metal cabinetry and associated countertops.

A smaller fraction of the funds were used to update research, such as the microelectronic probe station, and to refurbish the HeCd laser for the Raman Spectrometer. Specialized instrumentation like the Martin Expert system used in astrophysics research often can't be purchased but must be developed in-house. Henes funds were also used to buy equipment for the nanotechnology, atmospheric science, magnetic resonance, and optics labs—even the machine shop!

Recent Degree Recipients

	Destination
2012 Subhasish Mandal, PhD	Carnegie Instit. of Science
Nigel Anton, BS Daniel Burrill, BS Ryan Connolly, BS Xin Xin (Zoe) Fan, BS Justin Holmes, BS Mark Ingram, BS Greg Lau, BS Ed Leonard, BS Arin Nelson, BS Perry Nerem, BS Peter Solfest, BS	UMBC University of Vermont Michigan State Michigan Tech U. of Colorado, Boulder AFRL, Dayton University of Wisconsin University of Wisconsin U. of Colorado, Boulder Coll. of William & Mary Michigan Tech
2011 Rachel Blaser, MS Mathew Hollinger, MS Abhishek Prasad, PhD Amir Shahmoradi, MS Mukul Tewary, MS	Ford Motor Company Keramida Inc. Intel U. of Texas at Austin University of Toronto
Albert Patrick, BS Joseph Wilm, BS	Baraga High School Lockheed Martin

Blended Learning

The Center for Teaching and Learning (CTL) held a Lunch and Learn on the topic of blended learning. CTL director Mike Meyer touched on the use of discussion boards in the classroom. One discussion board type is included with Michigan Tech's new course management system Canvas. He compared it with a free discussion tool called Piazza. Both can be used by students to discuss homework solutions, define concepts, or ask or answer questions in a convenient online way. Piazza provides a single question-single answer format, easy searching, and LaTeX encoding of formulae. This makes it advantageous for discussions about physics problems.

Will Cantrell and Claudio Mazzoleni discussed the method of Just in Time Teaching, inspired by the book of that name by Novak *et al.* According to Mazzoleni, the method calls for warm-up quizzes on assigned reading material not yet covered in lecture. The warm-ups are delivered a day or two before each class. Immediately after each lecture, students are given a puzzle. These are short, follow-up problems designed to test the students' retention of the material. They are graded promptly to complete the feedback cycle. Both diagnostics allow the instructor to forge the lecture around the needs of the student and to use the in-class time more effectively. Cantrell commented on the simplicity of the process utilizing the Canvas learning environment. Quizzes built in Canvas have statistical capability for showing class responses as a whole.

Dean's List

Spring 2012 4.00

Adler, Michael C.	SR
Connolly, Ryan P.	SR
Furlich, Greg D.	SR
Holmes, Justin C.	SR
Ingram, Mark V.	SR
Nicklas, Brent C.	SR
Solfest, Peter M.	SR

Spring 2012 3.50-3.99

Brennan, Mackenzie P.	SR
Brouillette, Misty R.	JR
Burrill, Daniel J.	SR
Fan, Xin Xin	SR
Knecht, Carlo A.	SR
Lau, Gregory M.	SR
Leonard, Edward M.	SR
Makoutz, Emily A.	SR
Malec, Benedict J.	SR
Nelson, Arin D.	SR
Plamondon, Tyler J.	SR
Small, Mick D.	SO

Graduate Spotlight

Pradeep Kumar



Pradeep Kumar, a PhD student studying engineering physics, is doing research in the field of magneto-optics and photonics. Pradeep came to Michigan Tech in fall 2006 and joined the group of Prof. Miguel Levy in summer 2007. His PhD research addresses an important technological need, namely the development of on-chip isolation function for photonic integrated circuits. Isolators are critical components that protect signal stability in optical circuits by blocking out back-reflected light. A model system was developed by Pradeep and Prof. Levy consisting of photonic crystal lattices in the form of one-dimensional waveguide arrays in silicon-on-insulator platforms with magnetic garnet cover layers. An optical force is introduced into the array through geometrical design, pushing the beam sideways. Laterally displaced photons are periodically returned to a central guide by photonic-crystal action, producing beam revival in the central guide. The model is based on semiconductor platforms, making the outcome of the project particularly appealing for integration with existing silicon technology.

Pradeep gratefully acknowledges academic and financial support from Prof. Levy, the Department of Physics, and the Graduate School at Michigan Tech. He plans upon graduation to pursue a career in research and development. Pradeep is a recipient of the Dean's Award for Outstanding Scholarship, for which he was nominated by the Department of Physics. He also received Finishing Fellowships from the Michigan Tech Graduate School.

New Degree Programs

The Board of Control approved a Bachelor of Arts in Physics and Bachelor of Arts in Physics with a concentration in secondary education starting fall 2012. The degrees are offered in order to provide a strong foundation in physics, but with fewer course requirements. This track flexibility is expected to create more job opportunities for majors.

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

David '64 & Mary Carlson
Pamela '66 & Floyd Croy
John '50 & Eugenia Evans
Frank '58 & Shirley Hastedt
Joe A. Jenney '60
James J. Kaufman '67
Walter '64 & Margaret Kauppila
Clyde '50 & Gertrude Kimball
James '66 & Kathleen Kortge
Arne '52 & Joyce Koskela
Jack '62 & Kaethe Labo
Norman '61 & Sara-Jo Larsen
Robert '61 & Eugenia '64 Lind
Thomas '69 & Sharon Plutchak
Joseph Roti Roti '65 & Stephanie Pagano (dec)
Burriss '64 & Katherine Smith
James '63 & Janice Strahl
Michael '64 & Mary Ellen Teneyck
C. John '64 & Kathryn Umbarger

Roger '66 & Linda Urbaniak
Werner '66 & Tamara Vogt
William E. Wuerthele '66
Charles '66 & Mary Zeigler
Edward Augustyniak '94 & Monika
Sujczynska
David '88 & Elizabeth '88 Witteveen
Zhong Zhong '92 & Chunmei Tang '95
David E. Woon '84
Ziyong '88 & Ping Cai
Eric '83 & Kari Duffin
Donald '84 & Ann '86 Parry
Todd '85 & Kathleen '86 Rose
Charles J. McEwan '74
Manuj Rathor '96 & Shweta Singh
Samuel '63 & Brenda Ochodnick
Philip Kaldon '88 & Deborah Morrow
Thomas '84 & Renee Kugler
Jeffrey '84 & Suzanne Morris

Amin '95 & Lily '94 Sutjianto
William '78 & Kathleen '77 Wilson
Suresh K. Sampath '98
SriramaSwaminat Venkataraman '98
Stephen '02 & Jaime Beranek
Thomas '63 & Dona Gould
Daniel A. Nezich '03
Adam J. DeConinck '07
Matthew W. Davenport '06
Friends
Gary P. Agin
Mabel & Paul '49 (dec) Shandley
Keith & Wilma Baldwin
Richard & Elizabeth Henes
Paul & Elsie Hinzmann
Thomas & Sharon Silvis
Edward & Nina Nadgorny
Jeffrey & Carolyn Holmes
David Nitz & Mary Marchaterre

Robert Nemiroff

Research Award



Professor **Robert Nemiroff** was selected as one of the recipients of the 2012 Research Award from Michigan Tech. In nominating Nemiroff, physics professor **Don Beck** and **Ravindra Pandey**, chair of the physics department, cited his research based on gravitational lensing, noting that his groundbreaking predictions regarding binary stars, quasars and microlensing events have been proved correct. In another project, Nemiroff and his graduate students searched gamma-ray bursts to find “echoes” caused by the gravitational lens effect of dark matter. His outreach efforts include the extremely popular Astronomy Picture of the Day, a project of NASA. Nemiroff has introduced the “Ask Mr. Wizard” idea in his introductory astronomy classrooms. “He really cares about teaching,” said Jay Norris of Boise State University. “Bob’s quest to understand Nature—and transfer that understanding to others—is unflagging.”

Vasant Potnis

Physics professor emeritus **Vasant Potnis**, who retired from Michigan Tech in 1996, passed away Sept. 15 in Gwalior, India.

Potnis was born in 1928 in India and earned BSc, MSc and PhD degrees from Agra University before traveling by boat to the US in 1954. He came to Michigan Tech in 1968 from Kansas State University. Potnis’s research focused on low-energy nuclear physics, beta and gamma ray spectroscopy, and time variations of cosmic radiation. He published numerous papers.

Physics faculty and former graduate students remember Potnis as easy going and helpful. He provided much-needed external visibility as a fellow of the American Physical Society. He was a very rational individual who took great pride in physics and in thinking scientifically. In his retirement Potnis enjoyed playing bridge. He took art classes and demonstrated great talent with his sketches and paintings, both from life and from photographs. The Potnises split their time between Houghton and Gwalior, where Vasant owned a casting business. He is survived by his wife, **Kusum**.



Miguel Levy

Fellow of the Optical Society

Professor **Miguel Levy** has been named a Fellow of The Optical Society. Levy was recognized for outstanding and fundamental contributions in the areas of magneto-optic and opto-electronic films, and extensions of the theory and applications of magneto-optic photonic crystals.

Will Cantrell

Distinguished Teaching Award



Associate professor **Will Cantrell** was honored in the professor/associate professor category for 2012. Cantrell was praised by his students for his commitment to the classroom, for exceeding expectations, for providing positive feedback and for giving constructive criticism. His success in working with students is due in part to the physics department’s strong emphasis on quality teaching, Cantrell said, which makes his job easier. “He has become a very great mentor,” said Ravi Pandey.

Senior Spotlight

Joseph Charnawskas



Joseph Charnawskas is a third year undergraduate physics and history dual major. Near the end of his first year, Joseph became an active member of the Society of Physics Students. He became an officer his second year, and this year he was elected President of the Michigan Tech chapter. He is currently working with several departments on campus to organize a community outreach event (Family Physics Night) at the local elementary school, continuing the strong tradition of physics outreach at Michigan Tech. Midway through his second year, Joseph began working with **Dr. Robert Nemiroff** on a solar flare project. Their collaboration continues on a gamma ray burst project this year. Joseph became a physics Teaching Assistant during his second year, receiving an American Association of Physics Teachers Outstanding Learning Assistant award as a first time Teaching Assistant. Although passionate about astrophysics research, his primary goal is a career in physics and history education at the secondary or university level. Joseph would not be where he is today without the support of the close community of friends and faculty within the physics department, for which he is extremely grateful.

Reality provides us with facts so romantic that imagination itself could add nothing to them.

—Jules Verne

MichiganTech

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

**THANK YOU FOR EXPLORING THE
SCIENCE BEHIND THE MYSTERY
WITH MICHIGAN TECH
MIND TREKKERS**



Mind Trekkers 2012

April 14th, 2012 in Wisconsin at the 1st Annual Sheboygan Science and Engineering Festival. This demo is called "Liquid Nitrogen Explosion." It entails filling a soda bottle half full with LN₂, capping it, sinking it in a bucket of water, and then waiting. Recent physics graduate Ed Leonard is shown in the foreground. Photo is used with permission by the Michigan Tech Mind Trekkers.
