

# Physics News

MICHIGAN TECH PHYSICS DEPARTMENT NEWSLETTER

Fall 2003

Volume 5

## A note from the chair

By Dr. Ravi Pandey  
Professor and Chair

I am pleased to report that the Physics Department continues to move forward on several fronts, in spite of persistent cuts in the departmental budget due to declining state support for higher education. We have taken significant steps to enhance the undergraduate degree program. One of the steps includes awards of the Summer Research Fellowship to the undergraduate students. These awards allow the students to work on the research projects under the supervision of the faculty members. Another step focuses on a smaller class size for the students in the introductory physics courses. These steps have improved the undergraduate retention rate and have also been useful in attracting new majors in to the program. The enrollment of the current freshman class is one of the largest in the past few years.

Research is flourishing within the department. Our graduate program has emerged as one of the most productive PhD programs at MTU, accounting for one of nine PhD degrees awarded by the University. Mike Larsen working with Prof. Alex Kostinski and Jacob Fugal working with Prof. Raymond Shaw are the recipients of the DOD and NSF graduate fellowships, respectively. If you have not recently visited us on the Web, I invite you to visit the site for a detailed overview of our research activities: [www.phy.mtu.edu](http://www.phy.mtu.edu)

Building the department's endowment for summer research experience for undergraduates is now the primary objective of our department. In the past year, we have used income from endowment funds and a generous gift by Frank (BS, 1958) and Shirley Hasted to support the Summer Research Fellowships.

Finally, I would like to encourage you to keep us informed about milestones in your career and personal lives. We would like to devote part of each annual newsletter to news about our alumni. This is a good way for all of us to stay in touch. *Best wishes for a joyous holiday season and a happy and prosperous New Year.*

## Current Research: Jacek Borysow

By Sue Hill and Jacek Borysow



In July 2003, the National Science Foundation funded a joint experiment proposed by University of Texas at Austin, Michigan Tech. University, Brandeis University, and University of Nebraska, Lincoln, aiming to measure the mass of the neutrino. This quest has spanned forty years of science history. Jacek Borysow, Associate Professor of Physics, has become one of the lead scientists working on the experiment designed to measure the mass of the neutrino.

Currently, the NSF project "Determination of mass of electron antineutrino via tritium beta decay" has been funded for \$400,000, of which \$90,000 is MTU's share. This ambitious proposal moves beyond the standard model of the neutrino, which predicts that the mass is zero. The neutrino is a sub-atomic particle that interacts weakly with matter and travels at speeds close to that of light. Neutrinos are produced in stars when hydrogen nuclei are burned into helium. Neutrinos are very difficult to detect. A neutrino born in the center of our sun passing through the entire earth has a one in a thousand billion chance of being stopped by earth's matter. Standard theory predicts that billions of neutrinos pass through every  $\text{cm}^2$  of earth's surface every second. According to the same model, neutrinos have no mass.

The theory of the neutrino has evolved considerably since the first experiment in 1964. Recent models propose that neutrinos are produced as a mixture of states. The individual "personalities" can be observable or invisible, and neutrinos are thought to oscillate between these states. A consequence of the oscillation theory is that the multiple

*Continued on Page 2*

## Current Research: Jacek Borysow

*Continued from page 1*

states have tiny masses. In 1998 an international group of scientists in Japan confirmed oscillations of neutrinos and subsequently provided evidence that the neutrino has mass. Work on neutrino physics attracted attention recently when Raymond Davis won the Nobel Prize in physics in 2002 for his "pioneering contributions to astrophysics," which included the detection of cosmic neutrinos.

One of the most compelling mysteries of cosmology concerns the apparent "missing mass" of the universe, which would account for 85% of all matter. The belief that neutrinos could provide this mass is a cornerstone of the NSF proposal. No one knows what the mass is. The Texas/Houghton neutrino experiment is based on measurements of the shape of the endpoint of the energy spectrum of electrons formed by beta decay of tritium with higher resolution than any known attempts before. The unique spectrometer designed to avoid systematic errors encountered in previous experiments, will be assembled from components conceived and built at MTU and University of Texas at Austin. Borysow and his two graduate students have only recently begun projects leading to the understanding of this intriguing and important issue of neutrino mass.

Before becoming involved with neutrino physics, Borysow did research on the physics of atoms, molecules and lasers. He built a state-of-the-art atomic, molecular, and laser research laboratory after he arrived at Michigan Tech fourteen years ago. He was successful in attracting more than \$450,000 in funding for this work and has been an invited speaker at numerous science institutions and conferences. Four students received PhD degrees based on work done in his laboratory.

## Departmental Coordinator

Elizabeth (Beth) Pollins received a permanent appointment as Departmental Coordinator in May 2002. Previously she worked for more than 13 years for the Transportation Center: Local Technical Assistant Program (research project in Civil & Environmental Engineering). Beth enjoys working in academics and in a university setting. She likes the direct contact with students, faculty and staff from all areas of the globe.



## Department Update

Dr. Raymond Shaw was recently promoted from Assistant to Associate Professor of Physics and Dr. Robert Nemiroff was promoted from Associate Professor to Professor. Congratulations to both of them.

Dr. Christ Ftaclas changed his status with MTU Physics to Adjunct Professor in January 2003. He went on to become part of the graduate faculty of the University of Hawaii.

Dr. Michael Wertheim retired as Professor of Physics at the end of Spring Semester 2003. He joined the Physics Department in 1990 as a Professor. He received his PhD in Physics in 1957 from Yale. Before coming to Michigan Tech he held faculty positions at Rutgers and University of Guelph. Dr. Wertheim specializes in the theory of liquids, using statistical mechanics to calculate the thermodynamic and dielectric properties of fluids. He has advanced basic theory, computed results for chemical engineering, investigated bulk fluids, studied polymerization and inductive forces, and contributed to the modern theory of the gas-liquid interface.

We wish Drs. Ftaclas and Wertheim the best in their future endeavors.

## Senior Spotlight

*Mike Ftaclas*

"I'm working with Dr. Shaw for my Senior Research. I'm using a Monte Carlo simulation to investigate the effects of particle location correlation on stochastic coagulation and light attenuation in clouds. It is in part a continuation of the work Dan Lanterman did for his Senior Research.

"The most interesting experience, or collection of experiences, I've had at MTU has been working as General Manager of the campus radio station, WMTU. It's certainly different from the normal routine for a physics student.

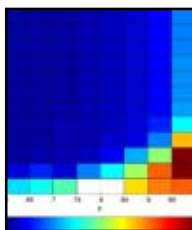
"I want to go to graduate school to study quantum cosmology, and eventually earn a PhD and become a professor." -mf

# Grad Student Spotlight

Mike Larsen

PhD Advisor Alex Kostinski

“Most of my research so far has been in atmospheric microphysics. My collaborators and I have found that many atmospheric constituents (e.g. aerosol particles, cloud droplets, and rain) are not distributed in a statistically independent manner. Many of the theories in atmospheric dynamics, however, assume that these constituents are perfectly randomly distributed. Most of my work to date has been in finding the magnitude of these departures from pure randomness and in suggesting appropriate modifications to the current theories of atmospheric radiative transfer, cloud/aerosol particle growth, and related fields.” -ml



## Awards and Achievements

Graduate student Michael L. Larsen, who is working on a PhD in Physics, has been selected to receive the prestigious 2003-2004 National Defense Science and Engineering Graduate (NDSEG) Fellowship.

Jacob Fugal, a Ph.D. student in Physics, was awarded a National Science Foundation Graduate Research Fellowship—a prestigious, three year award offered to approximately 900 outstanding graduate students nationwide each year.

Dr. Robert J. Nemiroff, Professor of Physics, is the first author of the book "The Universe: 365 Days" with Jerry T. Bonnell. The book was published by Abrams of New York, New York in May 2003.

## Events

Nemiroff also organized “Mars Night” at Michigan Tech on August 27, 2003. This event attracted 1,000 people to campus and was reported by WLUC-TV, TV-6 in Marquette.

The MTU Open House held on Sept. 27, 2003, broke attendance records with 1,100 students, parents and family members from nine states. More than 50 parties visited the Physics Booth at the Expo and toured the labs.

# Recent Degree Recipients

## 2003

Hutian Jiang, PhD

Wellesley Pereira, PhD

Nathan Erickson, BS

Daniel Nezych, BS

Katrina E. Black, BS

Nathanael D. Black, BS

David Harrington, BS

## Destination

University of Minnesota,  
Minneapolis

Michigan Tech

Univ. of Texas at Austin

Massachusetts Institute  
of Technology

University of Maine

University of Maine

University of Hawaii

## 2002

Anil Kandalam, PhD

Virginia Commonwealth  
University, Richmond

Zhaolin Lu, MS

Joe Darling, MS

Shankar Ghimire, MS

Dan Boline, BS

Nathan Jones, BS

Peter Kiefer, BS

Michigan Tech

Boston University

W. Virginia University

MIT-Lincoln Lab

# New Physics Facilities

The Integrated Photonics and Materials Integration Laboratory serves the fabrication, testing and analysis of photonic and piezoelectric materials and film-based devices. This lab is located in the M&M Building and operated by Dr. Miguel Levy. Tools include an rf magnetron sputtering system for the fabrication of magneto-optic films; an electron-beam writing system for nano-patterning of photonic structures; a metal evaporator for the deposition of electrodes; a micro-manipulator; a prism-coupler for the study of refractive indices and film thickness; and an optical testing laboratory for the analysis of waveguide devices.

The Materials Physics and Laser Physics Laboratory is for the synthesis and characterization of single crystals, thin films and nanostructures. Occupying multiple rooms in Fisher, this lab is operated by Dr. Yoke Khin Yap. The lab includes a Dual-RF-plasma Chemical Vapor Deposition System, a Dual-RF-plasma Pulsed-Laser Deposition System, and a Thermal Chemical Vapor Deposition System.

# Senior Projects

This year's senior projects include "The Central Star Binary Population" by Andrew Fleming, "Program in ForTran for Calculating Hyperfine Structure Corrections" by Greg Foster, Jr., "Monte Carlo Testing of Correlation Dependence of Stochastic Coagulation and Light Beam Attenuation in Clouds" by Mike Ftaclas, "Modeling the Response of Quartz to RF Pulsing as Similar to a Nonlinear Harmonic Oscillator" by Jason Kestner, "Turbulence in Aerosol Particle Clouds" by Joe Kuehl, "Mechanics of Piezo-electric Materials" by Timothy Lapham, "Growing Cubic Boron-Nitride Films by Pulsed Laser Deposition" by Nick Lightfoot, "Experimental Determination of Correlations in Aerosol Particles" by Chris Occhipinti, and "Growth Properties of Carbon Nanotubes using Dual Radio Frequency Plasma Chemical Vapor Deposition" by Ben Ulmen.

# Thanks!

We extend our deepest appreciation to friends and alumni who have made a recent contribution to the University. You, the donor, can specify the Physics Department for your contributions.

## Alumni

Carl & Marlene Adams '62  
Kent & Patricia Barlow '57  
John L. Baxandall '63  
Dwight & Adelaide Bishop '49  
Donald & Sharon Bullock '57  
James F. Capizzo '76  
David & Mary Carlson '64  
James D. Chye '96  
Michael C. Coleman '69  
Donald & Charlotte Daavettila '56  
Peter DeGroot & Myrl Bishop '62  
James & Dianna Gibson '63  
Harold & Rosanna Hansen '51  
Frank & Shirley Hastedt '58  
Masato Hiratani '00  
Peter N. Jansen Jr. '52  
John & Elaine Johnson '64  
Lloyd & Brenna Kaufman '93  
Bruce & Peggy Knivila '63  
Keith LaFleur & Diana Foglia-LaFleur '72  
Michael L. Larsen '01  
Richard & Barbara Liedtke '68  
Robert & Eugenia Lind '61

# Remembering a Colleague

Charles Earle Mandeville III passed away on January 14, 2003. Mandeville was a nuclear physicist who became head of the Physics Department at Michigan Tech in the early seventies. He worked at such places as MIT, the Bartol Research Foundation, University of Alabama at Tuscaloosa, Kansas State University, and Kaman Nuclear. His research interests involved gamma-ray spectroscopy, and he did early pioneering work on beta decay of nuclei. Mandeville was a musician and a collector of antiques and art objects. He settled in Socorro, New Mexico after retirement. He was a man of many accomplishments and will be missed by all who knew him.

*My goal is simple. It is complete understanding of the universe, why it is as it is and why it exists at all.*  
-Steven Hawking

Gordon & Carla Lyon '64  
Robert & JoAnn Matheson '49  
Ronald L. McKee '56  
Dale & Lauren Mukavetz '68  
Robert & Doris Pohanka '64  
Mary J. Repar '75  
Joseph & Stephanie Roti Roti '65  
Joseph & Susan Rowe '70  
Gregory B. Russell '92  
Christopher T. Schmidt '90  
Gerald & Patricia Schroeder '71  
Richard & Mary Ann Spigarelli '63  
Anthony & Sharon Suppelsa '63  
John P Thyren '94  
C. John & Kathryn Umbarger '64  
Howard & Marjie Wilson '59  
Larry & Patricia Wittenback '61  
Dr. David E. Woon '84

## Friends

Winifred & Frank Blackford  
Jacek Borysow & Katherine Cocciarelli  
Brenda & James Cross  
Paul & Elsie Hinzmman

# CONCAM Updates

By Dr. Robert Nemiroff

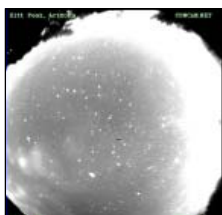
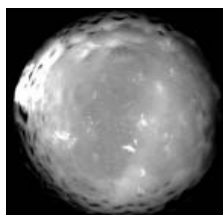
Michigan Tech's Night Sky Live project now deploys CONTinuous CAMeras (CONCAMs) in the Southern Hemisphere. With the addition this year of new CONCAMS in Siding Spring, Australia and Sutherland, South Africa, the network of night sky cameras now has the unique ability to see most of the night sky most of the time. Other Night Sky Live network nodes are located in Hawaii, California, Arizona, Florida, New Jersey, the Canary Islands, and Israel. The cameras use fisheye lenses to see from horizon to horizon and instantly post their images to <http://concam.net/> for anyone to see.

This year the project's design and optics were the focus of the Wellesley Pereira's just completed PhD thesis. Last summer the project provided summer research experience for undergraduate physics majors Andrew Fleming and Michael Ftaclas. This summer the undergraduate researchers were Daniel Cordell and Hiromichi Nishimura. Research topics included counting meteors, tracking the variability of stars, and searching for the optical counterparts of gamma-ray bursts.

This fall the project is proud to welcome Lior Shamir as a new graduate student who comes to Michigan Tech after already having written an impressive software package specifically for the reduction of CONCAM data. Major collaborators in the design and implementation of CONCAMS at Michigan Tech include Bruce Rafert, now Dean of the Graduate School, and David Cook, the Physics Department machinist.

Over the past year the Night Sky Live project has built a collaboration involving professors from other universities including John Oliver (U. Florida), Chris Impey (U. Arizona), and Noah Brosch (Tel Aviv U.).

Two new grants acquired over the past year are helping to fund the project. One is an NSF Information and Technology Research grant focusing on turning CONCAM images into useful data on sky clarity and opaqueness. The other, an NSF Course Curriculum and Laboratory Improvement grant, leverages CONCAM images for the creation of learning modules and time-lapse movies of the real sky for educational purposes.



# NSF NUE Initiative

Nanotechnology is one of the emerging technologies actively promoted at Michigan Tech. A true multi-departmental initiative just received NSF funding last summer: *Undergraduate Exploration of Nano-Science, Applications, and Societal Implications at Michigan Tech*. Dr. John Jaszczak, Associate Professor of Physics, is Principal Investigator of this proposal. The proposal focuses on education about the underlying science, applications, and societal implications of nanoscale technology. The initiative includes a lecture series, educational modules, original scientific animation, and a new course for Spring 2004: *Fundamentals of Nanoscale Science and Engineering*. NUE participants also include 3 co-PIs, 9 senior personnel, and 14 other participating faculty across campus.

[www.phy.mtu.edu/nue/index.htm](http://www.phy.mtu.edu/nue/index.htm)

## Ian W. Shepherd Award

The 2003 recipient of the Ian W. Shepherd Award was physics senior Dan Nezich. Dan's senior research was "Thermal Chemical Vapor Deposition of Carbon Nanotubes", advised by Dr. Yoke Khin Yap. Dan headed for MIT after graduation.

## Faculty Spotlight

*Ulrich H. E. Hansmann*  
Associate Professor  
PhD, Freie Universitaet  
Berlin, Germany



"Curiosity kills the cat. But in physics it is the basis of success. The question that interests me is how do the proteins in our body fold into the specific form in that they are biologically active? Can we understand why this process sometimes fails and leads to the outbreak of diseases? And what can we do to inhibit such misfolding? What I like most about my job is that it allows me to explore these questions and to follow my curiosity."  
-hansmann@mtu.edu

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Michigan Technological University  
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Houghton, Michigan 49931

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# Michigan Tech Physics Alumni - Stay Updated

We would like to stay in touch. Please tell us about yourself and whether you would like your information posted on the web.

|                                 | Post on the Physics website? | Yes                      | No                       |
|---------------------------------|------------------------------|--------------------------|--------------------------|
| Name _____                      |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Current position/employer _____ |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Degree and year _____           |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Address _____                   |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Phone _____                     |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Email/website _____             |                              | <input type="checkbox"/> | <input type="checkbox"/> |
| Other information _____         |                              | <input type="checkbox"/> | <input type="checkbox"/> |

Feel free to  
attach  
information.

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

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