

## NOTE FROM THE CHAIR

This has been quite a year for all of us. In the middle of the spring 2020 semester, all classes at Michigan Technological University transitioned to an online format as a preventive measure against COVID-19. We returned to campus for the fall, offering a hybrid model of teaching where we combined in-person and remote instruction for our students. Among faculty and staff, **Wil Slough**, director of first-year programs, and **Doug Wilken**, laboratory associate, deserve special recognition for their outstanding efforts in making a smooth transition to remotely teaching the introductory physics laboratories ( $\approx 1,000$  students in 50 lab sections).

**Professor Issei Nakamura** is our newest NSF CAREER award winner. This award recognizes exceptional early-career scientists in academia and is one of the highest honors given by the US government to young faculty members in engineering and science. Nakamura joined the department in January 2017 to initiate the research program in soft-matter physics. In his NSF CAREER project, he will work on the simulation of ion-containing liquids, which have recently drawn substantial attention in industry because of their energy-related applications.

**Jeff Kabel** is the recipient of the King-Chávez-Parks Future Faculty Fellowship. Kabel is a first-generation college student who has successfully managed numerous challenges through his sheer determination to pursue his interests in physics. As a KCP future faculty fellow, Kabel will help the department expand our opportunity to engage students of underfunded school districts of Michigan in the field of nanotechnology.

**Professor Raymond Shaw** has been elected as a Fellow of the American Physical Society (Fluid Dynamics) and **Professor Yoke Khin Yap** has been appointed as a Michigan Tech University Professor. Shaw received recognition for seminal contributions to the understanding of atmospheric turbulence's role in cloud processes, from droplet nucleation to growth through condensation and coalescence. Michigan Tech recognized Yap's outstanding scholarly contributions in the area of B-C-N nanomaterials.

We are extremely pleased to welcome **Assistant Professor Kartik Iyer** to the department. Iyer has an extensive research background in fluid mechanics, which will strengthen the atmospheric physics group in the department. Congratulations to **Professor Will Cantrell**, who has made a transition to his new role as dean of the Graduate School, and to **Professor John Jaszczak**, who has accepted the position of director and curator of the A. E. Seaman Mineral Museum.

**Professor Bryan Suits** recently published the book *Electronics for Physicists: An Introduction*, which provides a sound basic understanding of electronics and how it is used, principally in the physical sciences. It is worth mentioning that the last undergraduate-level book published by the physics faculty was in 1939. The book, entitled *Essentials of General Physics* (Edwards Bros, Ann Arbor), was written by Professors J. H. Service and F. L. Partlo.

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 ([mtu.edu/physics/giving](http://mtu.edu/physics/giving)). Your continued support is deeply appreciated.

Best wishes for a joyous holiday season and a happy and prosperous New Year. **–Ravindra Pandey**

## CURRENT RESEARCH

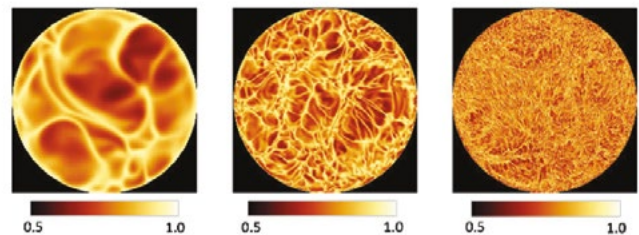


### Kartik Iyer

Thermal convection—the active transport of heat by a moving fluid—underlies many of nature's dynamical designs. From causing winds to blow and oceans to flow to generating the magnetic field that protects us from solar winds, thermal convection is a fundamental physical process that helps sustain life on Earth. In a majority of these processes, the state of the fluid motion is almost always turbulent, characterized by

thin thermal boundary layers and chaotic dynamics. Given the plethora of physical processes that depend on transport of heat by turbulent convection, the determination of the rate at which heat is convected by a turbulent fluid is an important open problem in fluid dynamics.

Inspired by a minimal mathematical model due to Henri Bénard and Lord Rayleigh, this problem is known as “Rayleigh-Bénard convection”. Assistant Professor Kartik Iyer's research strives to address this open question by simulating Rayleigh-Bénard convection using three-dimensional simulations of turbulent convection. He has played a leading role in quantifying the turbulent heat transport rate as a function of the Rayleigh number, which is a dimensionless measure of the vigor of convective turbulence, at unprecedented Rayleigh numbers. These state-of-the-art simulations requiring over 500,000 cores are the largest of their kind to date. Iyer's work at Michigan Tech aims to harness this computational expertise in studying the interplay between turbulent convection in a Rayleigh-Bénard convection cell and cloud particle dynamics in order to simulate cloud physics. Such simulations, which can provide detailed information about the interaction between the turbulent small-scales and the cloud droplet dynamics, will synergize ongoing experimental studies on cloud physics at Michigan Tech.



Temperature field (left to right) at Rayleigh number 1011, 1013, and 1015 inside the boundary layer of a Rayleigh-Bénard convection cell. Source: Iyer et al., *Proc. Natl. Acad. Sci.* (2020).

## MICHIGAN TECH UNIVERSITY PROFESSOR



**Yoke Khin Yap** has been elected as the 2020 Michigan Tech University Professor, which recognizes his outstanding scholarly contributions in synthesis, characterization, and applications of B-C-N nanomaterials. His research group has received more than \$10 million in research funding and published a series of high-impact journal articles (*ACS Nano*,

*Nano Letters*, *Advanced Materials*, *Nature Electronics*, *Nature Communications*, etc.), along with 15 book and encyclopedia review chapters. He received the Michigan Tech Bhakta Rath Research Award in 2011 and the Michigan Tech Research Award in 2018 for his leadership in BNNT research, providing some of the important breakthrough findings in the field. Yap is also an excellent instructor in the classroom and has led the department in making research opportunities available for a wide cross-section of students. He led the efforts with Professors Jaszczak, Friedrich, and Seely to develop an interdisciplinary minor in nanoscale science and technology. In addition, Yap has demonstrated success in technology commercialization by creating two companies, both receiving funding from the State of Michigan and NSF Technology Transfer programs.

## STAFF SPOTLIGHT

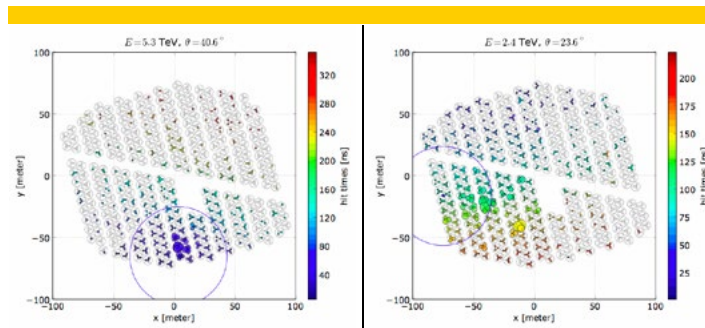


**Amanda Shaw** joined the physics department in 2003 as a part-time research assistant, transitioning to a graduate teaching assistant in 2012 and finally in 2016 to her current appointment as a part-time instructor. Shaw graduated from the University of Texas at Austin with a BA in Physics, Brigham Young University with a physics/mathematics secondary education teaching certificate, and Michigan Tech with

an MS in Applied Physics. Although she planned a career in teaching high school physics, Shaw discovered the rewards of teaching at the university level. She enjoys interacting with the physics faculty, especially collaborating with the instructors who teach the large engineering physics courses. Education proved to be a lifelong process for her as she focused her time and energy on building a family. Shaw and her husband have raised four children, three of whom have attended Michigan Tech as dual-enrolled high schoolers. The fourth, currently in high school, plans to take courses at Michigan Tech next year. Shaw and her family enjoy traveling, soccer games, skiing, and living in Houghton.

## OUTREACH

**Petra Huentemeyer** hosted the second Research Experience for Teachers summer program. During the six-week program, Matt Laird, an instructor at Finlandia University in Hancock, Michigan, and Heather Murphy, a teacher at Hancock High School, partnered with members of Huentemeyer's research group to create innovative high school lesson plans based on current work in astrophysics and gamma-ray astronomy. The lesson plans are available on the **Research Experience for Teachers website**.



*In one activity, students learned to distinguish between gamma-ray and cosmic-ray showers using simulated data from the High-Altitude Water Cherenkov Observatory.*

## RECENT FUNDING

**Issei Nakamura** is the Principal Investigator on a project that has received a \$196,000 research and development grant from the National Science Foundation. The project is titled, "CAREER: Coarse-Grained Theory and Simulation of Ion-Containing Liquids: Study of Ion Solvation by Polymers and Ionic Liquids and Between Nanoparticles." This five-year project could potentially receive a total of \$490,000.

**Raymond Shaw** is the PI on a project that has received a \$148,194 research and development contract with Brookhaven Science Associates LLC–Brookhaven National Laboratory. The project is titled, "Simulations to Support Designing a Cloud Chamber for Studies of Aerosol-Cloud Interactions."

**Will Cantrell** is the co-PI on this one-year project.

**Will Cantrell** received a Michigan Tech Research Excellence Fund award for infrastructure enhancement.

**Elena Giusarma** received a Michigan Space Grant Consortium award at the end of her first academic year at Michigan Tech; the project is titled "Learning to Simulate the Large-Scale Structure of the Universe with Convolutional Neural Networks".

Three graduate students were awarded fellowships.

**Elise Rosky** received a fellowship from the Michigan Space Grant Consortium, **Qi Zhong** received a Henes Fellowship, and **Binita Hona** received a Miles Fellowship.

Undergrads **Casey Aldrich** and **Renato Pinto Revegginio** received 2019 Summer Undergraduate Research Fellowships.

## AWARDS AND ACHIEVEMENTS

**John Jaszczak** was reappointed as interim chair of the Department of Chemistry for the 2019-20 academic year.

**Will Cantrell** was reappointed for the 2019-20 academic year as associate dean of the Graduate School to continue his efforts toward graduate program review and graduate student outcomes assessment. He began his new role as dean in July 2020.

**Yoke Khin Yap** was named 2020 University Professor by the provost in recognition of his outstanding scholarly contributions to the University and his research discipline.

**Jae Yong Suh** was promoted to associate professor.

**Wil Slough** was promoted to director of first-year programs.

**Bryan Suits** wrote *Electronics for Physicists: An Introduction*. The text, published by Springer, is the first undergraduate book published by a faculty member since 1939.

Several members of the department were recognized by the Jackson Center for Teaching and Learning. **John Jaszczak** received the CTL Instructional Award for Assessment for his involvement with full-class assessment in large classes.

**Katrina Black** and **Amanda Shaw** were named to the Dean's Teaching Showcase by David Hemmer, dean of the College of Sciences and Arts. Black was recognized for her ongoing curriculum and assessment reform in introductory physics courses. Shaw was recognized for her introductory physics instruction and curriculum development, particularly in PH2110, a new course designed to support at-risk students in introductory mechanics.

**Claire Wiitanen** received the 2020 Graduate Student Government Merit Award for exceptional staff member.

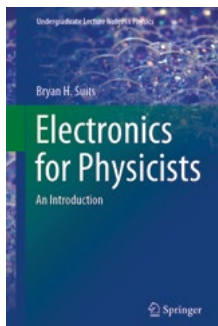
**Wil Slough, Robert Weidman, Raymond Shaw, Petra Huentemeyer, Mike Meyer, Katrina Black, Jeff Kabel, Jacek Borysow, Claudio Mazzoleni, Bob Nemiroff, and Alexander Kostinski** were recognized by students in a post-semester survey for their exceptional efforts in the transition to remote learning during the spring 2020 semester.

**Corey Packard, Qi Zhong, and Tyler Capek** received the Graduate School Outstanding Scholarship Award, while **Jesse Anderson, Seth Nelson, Jeff Kabel, and Susan Mathai** received the Outstanding Graduate Student Teaching Award.

**Qing Guo** and **Nurun Nahar Lata** are spending the 2019-20 academic year on internships at Los Alamos National Lab and Pacific Northwest National Lab, respectively. **Lisa Eggart** was at Lawrence Livermore National Lab during spring 2020.

**Adam Krueger** and **River Lerversee** were co-recipients of the 2020 Ian Shepherd Award for outstanding senior undergraduate student. Physics alumnus James Harrison '93 presented the award.

**Carter Mashburn** was named the 2019 Physics Departmental Scholar and nominated for the Provost's Award for Scholarship.



## ALUMNI SPOTLIGHT

**Parimal Kar PhD '09,**  
Indian Institute of  
Technology, Indore, India

After receiving his PhD in 2009, Kar went to the Max Planck Institute of Colloids and Interfaces, Germany, to work on computational modeling of molecular recognitions and mutation-induced drug resistance for HIV and flu. Later, he moved to Michigan State University (MSU) for his second postdoctoral appointment.

In the Feig lab at MSU, Kar developed multiscale coarse-grained (CG) and hybrid all-atom/coarse-grained (AA/CG) models of proteins to investigate the dynamics of large proteins for a longer time scale and received the Postdoctoral Career Potential Award.

In 2016, he went back to India and joined the Indian Institute of Technology Indore (IIT Indore) as an assistant professor. He was awarded the prestigious Ramalingaswami Fellowship by the Department of Biotechnology, India. In 2017, he received the Early Career Research Award from the Science and Engineering Research Board, India. He is currently working on structure-based drug design, conformational dynamics of glycans, and post-translational modifications in proteins via physics-based simulations ([iitibsbeparimalkar.wixsite.com/biophysics](http://iitibsbeparimalkar.wixsite.com/biophysics)).



## ALUMNI SPOTLIGHT

**Jason Kestner BS '04,**  
University of Maryland, Baltimore

Kestner is an associate professor in the Department of Physics at UMBC. After receiving his BS from Michigan Tech in 2004, he earned a PhD in physics from the University of Michigan in 2009. After a postdoctoral research appointment at Univ-MD, he joined the faculty of UMBC in 2012.

His theoretical research focuses on noise and noise mitigation for devices that usefully exploit the strange features of quantum mechanics. A prominent example is a quantum computer, which could solve a certain important class of problems exponentially faster than any classical computer. In particular, Kestner's group calculates how to precisely control the spin state of electrons in a variety of nanoscale semiconductor quantum dot structures despite the noisy environment in which the electrons reside.

Kestner notes, "I've always appreciated the way my professors at Tech challenged me and stretched my abilities, taking the time to interact one-on-one and give me personal feedback. Dr. Suits introduced me to the frustration and thrill of research, and Dr. Weidman's quantum mechanics course was absolutely life-changing. The education I received at Tech prepared me well for my research career in physics and set an example of teaching that I still try to emulate."





# ▶ 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, please contact [physics@mtu.edu](mailto:physics@mtu.edu). As always, we appreciate your continued interest in the Department of Physics at Michigan Technological University.

Gary P. Agin

Edward Augustyniak '94 & Monika Sujczynska

Theodore L. Bedore '72

Stephen '02 & Jaime Beranek

Jeffrey '79 & Rebecca Boyce

John '69 & Louise Bretney

Ziyong Cai '88 & Ping Zhou

Russell '63 & Joan Compton

Daniel I. Cordell '06

Eric '83 & Kari Duffin

Thomas '63 & Judith Essig

Charles G. Garrow '66

James '68 & Lynne Gekas

Thomas '63 & Dona Gould

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Jack '62 & Kaethe Labo

Jason A. LaCrosse '95

Samuel C. Lambert '62

Edward M. Leonard '12

Ronald '56 & Judith (dec) McKee

Paul '71 & Joanne Michaels

James '65 & Joan Mitchell

Thomas '76 & Margaret Mohr

Deborah Morrow & Philip Kaldon '88 (dec)

Dale '68 & Lauren Mukavetz

Marcus '81 & Lisa '82 Niessen

David Nitz & Mary Marchaterre

Brenda & Samuel '63 (dec) Ochodnický

Mary Jane Pell

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Joseph '70 & Susan Rowe

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Roger '66 & Linda Urbaniak

Srirama Swaminat Venkataraman '98  
& Kalpana Chandrasekharan

Larry '61 & Patricia Wittenbach

David E. Woon '84

William E. Wuerthele '66

Charles '66 & Mary Zeigler

Yajing Zhang '92

## GRADUATE SPOTLIGHT



**Nurun Nahar Lata** is a PhD candidate working with Will Cantrell in the atmospheric sciences program. She joined Michigan Tech in fall 2016 after finishing her master's in applied chemistry and chemical engineering at the University of Dhaka, Bangladesh, earning her undergraduate in the same discipline at the same university.

Lata's research interests lie in the chemistry and physics of aerosols and heterogeneous ice nucleation. In experiments conducted in

the Michigan Tech Atmospheric Physics Lab, she used a cold stage-based freezing technique to elucidate the mechanism of heterogeneous ice nucleation changing the surface properties of the substrate. The research has been published in the *Journal of Physical Chemistry Letters*.

Lata currently works as a PhD intern at Pacific Northwest National Laboratory with the aerosol chemistry research group. At PNNL, she uses multimodal microscopic and spectroscopic techniques to characterize the atmospheric aerosols and measure the ice nucleation propensity. She plans to finish her degree in summer 2021 and pursue a career in research, at a research institute or in academia.

## SENIOR SPOTLIGHT



**Carter Mashburn** is a fourth-year physics major. He has been involved with the Society of Physics Students and undergraduate research all four years he has been at MTU, and enjoys hiking, snowboarding, and music production in his spare time.

This past summer, Mashburn developed a pure rotational Raman lidar for high-precision atmospheric temperature sensing on a project with Jacek Borysow and secured a Michigan

Space Grant Consortium Fellowship for his senior academic year. Mashburn's senior research, supervised by Borysow and Claudio Mazzoleni, is on developing a Raman lidar apparatus for simultaneous measurement of atmospheric temperature and water vapor concentration.

After graduation, Mashburn plans to attend graduate school to pursue a PhD in atomic or biological physics. He is grateful for the opportunities, encouragement, and kindness provided by the physics department during his time here, especially from Borysow and Mazzoleni.

## GRADUATE SPOTLIGHT



**Jeff Kabel**, a PhD student working with Yoke Khin Yap, joined Michigan Tech in fall 2018. Kabel's research focuses on the synthesis, properties, and applications of lower-dimensional materials. Currently, his work focuses on using molybdenum disulfide quantum dots as the charge transport layer in zinc oxide thin-film solar cells. Study results are to be presented at the symposium for Nanotubes, Graphene, and Related Nanostructures at the Materials Research Society's fall meeting.

Kabel received the King-Chávez-Parks Future Faculty Fellowship, which will fund him for the next four years. The King-Chávez-Parks Future Faculty Fellowship was established to increase the pool of academically or economically disadvantaged candidates pursuing teaching or administrative careers in postsecondary education. Upon receiving his PhD, Kabel plans to pursue a career in academia.

## DEGREE RECIPIENTS

STUDENT	DESTINATION
<b>Chad Brisbois, PhD</b>	Postdoctoral Fellow, University of Maryland, College Park
<b>Kamal Chandrakar, PhD</b>	National Center for Atmospheric Research
<b>Binita Hona, PhD</b>	Postdoctoral Fellow, University of Utah
<b>Corey Packard, PhD</b>	ThermoAnalytics
<b>Jinlin Zhang, PhD</b>	Los Alamos National Laboratory
<b>Qi Zhong, PhD</b>	Postdoctoral Fellow, CREOL, University of Central Florida
<b>Kevin Bertschinger, MS</b>	Naval Surface Warfare Center
<b>Aishwarya Dahiwale, MS</b>	Internship, California Institute of Technology
<b>Armin Kalita, MS</b>	PhD, Rutgers University
<b>Seth Nelson, MS</b>	PhD, Physics, Michigan Tech
<b>Eduardo Rodriguez-Feo, MS</b>	Pacific Northwest National Laboratory
<b>Cameron Shock, MS</b>	PhD, Applied Physics, Michigan Tech
<b>Matthew J. Cowles, BS</b>	Research Assistant, StabiLux
<b>Matt J. De Mario, BS</b>	–
<b>Ian G. Herzog, BS</b>	MS, Physics, Michigan Tech
<b>Zack W. Hjorth, BS</b>	MS, Physics, Michigan Tech
<b>John W. Janisch, BS</b>	PhD, Physics, University of Central Florida
<b>Adam J. Krueger, BS</b>	PhD, Physics, Georgia Institute of Technology
<b>River A. Lerversee, BS</b>	PhD, Physics, University of Colorado Boulder
<b>Jason Lehto, BS</b>	Laurium Labs
<b>Megan E. Morgenstern, BA</b>	MS, Physics, Michigan Tech



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Elias Chasiotis

The December 28, 2019, Astronomy Picture of the Day ([apod.nasa.gov](http://apod.nasa.gov)) of the sun rising during a solar eclipse went viral. The photograph, taken by photographer and amateur astronomer Elias Chasiotis, was likened to "devil horns" by many. **Robert Nemiroff**, a co-creator of the site, appeared on CNN to explain the photograph, which combines the effects of a partial solar eclipse, atmospheric reddening, and the Etruscan vase effect, a type of mirage.