**Michigan Section of the American Association of Physics Teachers**

# Spring 2019 Meeting Announcement and Program Schedule

## University of Michigan, Ann Arbor, MI
## March 16th, 2019

## Program Highlights

We are pleased to welcome Ed Prather!

Dr. Edward E. Prather is a Professor in the Department of Astronomy, at the University of Arizona (UA). Ed is the Executive Director of the Center for Astronomy Education (CAE) at UA. His research focuses on investigating the teaching and learning of topics in STEM. Ed and his collaborators have conducted numerous research studies to uncover students' conceptual, reasoning and problem solving difficulties over a wide array of physical science topics taught in astronomy, astrobiology, physics, geoscience and planetary science. The results from these studies have informed the development of innovative active-learning instructional strategies shown to intellectually engage learners and significantly improve their understandings, problem solving abilities and self efficacy related to learning about science.

Dr. Prather will deliver the keynote address on Saturday entitled "Re-Thinking Astronomy and Physics Education: Lessons Learned from Two Decades of Experiments on College-Level Teaching and Learning."

## Program Overview

Location: Sessions and workshops will take place in **West Hall** on U of M's Main Campus: 1085 S University Ave, Ann Arbor, MI 48109

Registration: Registration cost is $10 per meeting. Students and first-time attendees, though, may attend *free* of charge.

Parking: Please consult the following URL for a parking map:
https://ltp.umich.edu/maps/central_south.pdf
Parking rates are hourly and run $1.60 per hour for lot parking and $1.20 per hour for structures

## Program Overview (cont.)

Lunch: We will be catering lunch from Jerusalem Garden. Lunch will be $10 per person.

Hotels: For those who wish to stay overnight for the meeting, a few suggestions for lodgings:

- Graduate Ann Arbor - walking distance
- Ann Arbor B&B - walking distance
- Bell Tower Hotel - walking distance
- Holiday Inn - driving distance
- Hampton Inn - driving distance

## Program Schedule

**7:30 – 8:10 am** **Registration/Morning refreshments**
340 West Hall
Meeting fee: $10.00 (FREE for students and first-time attendees)

**8:10 – 8:20 am** **Call to order and welcome**
340 West Hall
Taoufik Nadji, Interlochen Arts Academy – MIAAPT President
Opening Remarks from Dr. David Gerdes, Chair of UM Physics Dept.

**8:20 – 11:00 am** **Contributed Presentations I**
340 West Hall

8:20 – 8:35 Densities of Extra Solar Planets
Michael C. LoPresto and Alex Alajbegovic, University of Michigan
lopresto@umich.edu

8:35 – 8:50 The Physics of Destructive Earthquakes East of the Mississippi
Frederick J Thomas, Math Machines
Fred.thomas@mathmachines.net

8:50 – 9:05 Supporting an Intro Lab Redesign with E-CLASS and AAPT Guidelines
Helen Mae Cothrel, Kettering University
hcothrel@kettering.edu

9:05 – 9:20 Free Body Diagrams Beyond Free Body Diagrams
Michael C. Faleski, Delta College
michaelfaleski@delta.edu

# Program Schedule (cont.)

9:20 – 9:35 Teaching Phosphorescence and Fluorescence through Outreach
Lawrence Kolpajlo, Eastern Michigan University
lkolpajl@emich.edu

**9:35 – 9:50 Break**

9:50 – 10:05 Kinematics is Dead, Long Live Modern Physics
Taoufik Nadji, Interlochen Arts Academy
nadjit@interlochen.org

10:05 – 10:20 140x – Flipping Intro Mechanics at Scale
Tim McKay, University of Michigan
tamckay@umich.edu

10:20 – 10:35 What Can Departments Do to Increase Graduate Retention
Diana Schmpazidi, Western Michigan University
ntiana.sachmpazidi@wmich.edu

10:35 – 10:50 Detecting Solar Eclipses with Rooftop Solar Panels
Jordan K. Steckloff, Planetary Science Institute/ University of Texas at Austin
jordan@psi.edu

**10:50 – 11:00 Break**

**11:00am – 12:00pm** **Keynote Address**
340 West Hall

**Re-Thinking Astronomy and Physics Education: Lessons Learned from Two Decades of Experiments on College-Level Teaching and Learning**

Ed Prather, University of Arizona
eprather@as.arizona.edu

Over the past two decades, members of the Center for Astronomy Education (CAE) have created a national STEM education research collaboration of faculty, post-docs, graduate and undergraduate students all working together to better understand and improve the teaching and learning of introductory astronomy and physics. Our multi-institutional and iterative education research model has successfully informed the development of several innovative active learning and assessment strategies. These research-validated classroom strategies have been used to significantly improve the discipline knowledge, critical reasoning and problem solving abilities, and attitudes of hundreds of thousands of learners in STEM classrooms. I will discuss the findings from two important research projects from this work, and unpack how these results inform future STEM education work on the creation of effective in-person and online courses that can better address issues of retention, inclusion and diversity in STEM.

# Program Schedule (cont.)

**12:00 – 1:00** **Lunch (Jerusalem Garden)**
337 West Hall

**1:00 - 4:00** **Workshop I (concurrent with afternoon session)**
411 West Hall

Getting Our Students to Work in Every Class—From Fast-Paced Feedback Techniques to Facilitating Collaborative Quantitative Problem Solving
Ed Prather, University of Arizona
eprather@as.arizona.edu

Do you want to motivate your students to become active participants in their learning? So do we! Developed over the past 15 years by working with thousands of instructors, postdocs, and graduate students, this supportive and active workshop environment provides first-hand experience with a range of instructional strategies including interactive lecturing, Think-Pair-Share, and collaborative group activities (including interactive quantitative problem-solving, Lecture-Tutorials, Ranking Tasks, and Student Representation Tasks). These instructional strategies are designed to increase students' conceptual understandings as well as help them develop and improve their abilities to think critically, interpret graphs, reason about quantitative data, and improve their problem solving abilities and self-efficacy. Join your colleagues in learning more about how to transform your classroom into a vibrant learning environment with more motivated and confident learners!

**1:00 – 1:20 pm** **Poster Presentations**
Hallway Between 337 and 340 West Hall

Free Body Diagrams Beyond Free Body Diagrams
Michael C. Felski
michaelfaleski@delta.edu

Writing-to-Learn Activities in Introduction to Mechanics
Maya Chamra and Madhav Kumar
madhavkr@umich.edu

An Exploration into Student Conceptions of Systems through a Writing Activity
Rob Dalka
rpdalka@umich.edu

Understanding Boiling Points with Introductory E+M
Jordan K. Steckloff
jordan@psi.edu

# Program Schedule (cont.)

Densities of Extra Solar Planets
Alex Alajbegovic
lopresto@umich.edu

Scientific Practices in Minimally Completed Programs
Daniel Oleynik
oleynikd@msu.edu

Advancing Equity and Inclusion in STEM
Israa Ali, Tania Zaragoza, and Mairna Askar
aliim@umich.edu, ztania@umich.edu, mairna@umich.edu

**1:20 – 2:05 pm** **Contributed Presentations II**
340 West Hall

1:20 – 1:35 Identifying the Practices Associated with Computational Introductory Physics
Michael J. Obsniuk, Kettering University
mobsniuk@kettering.edu

1:35 – 1:50 It's Not That You Said it, it's How You Said it: Exploring the Linguistic Mechanisms Underlying Values Affirmation Interventions at Scale
Nia Dowell, University of Michigan
ndowell@umich.edu

1:50 - 2:05 A Demo Presentation from the UM Demo Lab
Monika Wood, University of Michigan
monikak@umich.edu

2:05-2:20 Scientific Practices in Minimally Completed Programs
Daniel Oleynik, Michigan State University
oleynikd@msu.edu

**2:20 – 2:50** **Business Meeting**
340 West Hall
Taoufik Nadji (Interlochen Arts Academy) – MIAAPT President
nadjit@interlochen.org

**2:50 - 3:35** **Lab Tours**
Meet outside 340 West Hall
Ramón Torres-Isea
rtorres@umich.edu
During this time, tours of the University of Michigan Intermediate and Advanced Labs will be available.

# Program Schedule (cont.)

**2:50 – 3:50** **Workshops II**
335 West Hall

2:50 – 3:50 Bringing Student Development Theory to the Classroom
Helen Mae Cothrel, Kettering University
hcothrel@kettering.edu

In this workshop, we will learn about student development theory and how it can inform your teaching. We'll learn broadly about different types of theories. Then, we will take some specific theories and discuss with each other how they are useful by applying them to case studies, examples, or ourselves. By the end of this workshop, you will gain a feel for what student development theory is and how you can draw from it to become a well-rounded educator.

2:50 – 3:50 Research-Based Resources for Teaching Introductory Physics in a Space Science Context
Bradley S. Ambrose, Grand Valley State University
ambroseb@gvsu.edu

Join this workshop to explore instructional materials appropriate for high school and introductory college instructors who want to teach basic physics concepts using space science content and authentic data. Attendees will sample selected labs and tutorials developed through the NASA Space Science Education Consortium. These materials address topics that integrate physics, earth science, and space science such as: (1) coronal mass ejections to understand simple kinematics and acceleration of relativistic particles, (2) sunspot data to understand period and frequency, and (3) auroral currents to understand electromagnetism. This workshop is supported by a NASA Grant awarded to Temple University and AAPT.

**4:00 pm** **Adjournment**

# Abstracts for Contributed Presentations

8:20 – 8:35 Densities of Extra Solar Planets

Michael C. LoPresto and Alex Alajbegovic, University of Michigan
lopresto@umich.edu

Most of the exoplanets discovered by the Kepler mission were detected by the transit method, which gives us the radius of the planet. Use of the radial velocity method has also yielded the mass of a number of them, which allows densities to be calculated as well. Plots of the densities vs. radius and radius vs. mass of these planets will be presented and comparisons with the densities of the planets in our own solar system to planets considered, based on their radii, to be of similar types will be made.

8:35 – 8:50 The Physics of Destructive Earthquakes East of the Mississippi

Frederick J Thomas, Math Machines
Fred.thomas@mathmachines.net

Even in Michigan, engineers design structures to withstand a "maximum considered earthquake," specified primarily as peak horizontal ground acceleration. Design considerations offer straight-forward applications of many physics topics, including PVA, inertia, energy, resonance, mathematical modelling and more. In addition to natural events, some earthquakes can be induced by human activities. A 1986 Ohio quake occurred near a waste-injection well and produced accelerations which exceeded design specifications at a nearby nuclear plant. This presentation is based on the IOP Concise Physics book, The Physics of Destructive Earthquakes, by the presenter, Robert Chaney and Richard Tseng of the non-profit organization, Math Machines.

8:50 – 9:05 Supporting an Intro Lab Redesign with E-CLASS and AAPT Guidelines

Helen Mae Cothrel, Kettering University
hcothrel@kettering.edu

We are currently overhauling our introductory E&M lab course with plans to roll out the new course in summer 2019. In this presentation, I will talk about baseline survey results (using UC Boulder's E-CLASS) and how we are using the AAPT laboratory curriculum recommendations (published in 2014) to approach our course revision. These resources support redesign by informing the course objectives and structure of weekly activities.

9:05 – 9:20 Free Body Diagrams Beyond Free Body Diagrams

Michael C. Faleski, Delta College
michaelfaleski@delta.edu

The free body diagram is a tool used in virtually all introductory physics courses as a way to analyze force problems. One standard introductory approach is to put all of the forces acting at the center of the mass and perform a Newton's Second Law analysis. Does this help students get a physical sense of what is happening? Some thoughts on how to present/construct the free body diagram is described that may help put the physical back into the physics for students is presented.

## Abstracts for Contributed Presentations (cont.)

9:20 – 9:35 Teaching Phosphorescence and Fluorescence through Outreach

Lawrence Kolpajlo, Eastern Michigan University
lkolpajl@emich.edu

Classroom activities and demos used to teach phosphorescence and fluorescence to K-12 students across disciplinary boundaries will be explored. Historical connections to physics are made. Spectra of fluorescent and incandescent bulbs are contrasted using diffraction gratings. Some demos include writing secret messages with fluorescein, uv pens, and tonic water. Other demos include fluorescent minerals. Even slime can be made to exhibit phosphorescence, using the same chemical that Rutherford used in his famous gold foil experiment. Related phenomena such as the prevention of counterfeit money, and blood detection in forensics will also be discussed.

9:50 – 10:05 Kinematics is Dead, Long Live Modern Physics

Taoufik Nadji, Interlochen Arts Academy
nadjit@interlochen.org

Kinematics has been overemphasized is most traditional physics curricula. The presenter shall offer an alternative pathway to physics learning whereby kinematics is deemphasized and modern physics is brought to the forefront.

10:05 – 10:20 140x – Flipping Intro Mechanics at Scale

Tim McKay, University of Michigan
tamckay@umich.edu

Physics 140 is the core introductory mechanics course at Michigan, taught to 1300 student a year. This year, our Foundational Course Initiative team is launching 140x: a new, fully-flipped, problem-based version of the class for more than 200 students. This talk will outline our design goals, describe pilot experiments, and invite advice from the audience.

10:20 – 10:35 What Can Departments Do to Increase Graduate Retention

Diana Schmpazidi, Western Michigan University
ntiana.sachmpazidi@wmich.edu

The results of prior studies on physics graduate education call for additional attention, mainly due to the persistent phenomenon of high attrition. In this study, we investigate the influence of departmental policies on students' self-efficacy and their career outcome expectations. We collect survey and interview data from physics graduate students from multiple institutions across the U.S. In this talk, we will present preliminary results of students' responses on the survey. The results of this study will be used to inform researchers and policymakers on how departments can help improve students' experience in the pursue of their graduate degree.

# Abstracts for Contributed Presentations (cont.)

10:35 – 10:50 Detecting Solar Eclipses with Rooftop Solar Panels

Jordan K. Steckloff, Planetary Science Institute/University of Texas at Austin
jordan@psi.edu

Photometers, devices that count photons and measure wavelength, are a very commonly used tool in astronomy. Astronomical photometers are ideally highly sensitive, accurate, and calibrated. However many other photosensitive systems record light activity, and can therefore act as a crude photometer. For example, rooftop solar panels detect events that affect the intensity of solar radiation, such as the Sun's changing position in the sky, passing clouds, and the solar eclipse of August 21st, 2017. In this talk, I discuss how to read the photometric signals in a rooftop solar panel array. The solar panel system I used is a 7.2 kW array for residential energy production, and records average power production at 15 minute intervals. The resulting power production curve contains clear signals of events that affect solar radiation intensity on the ground (solar flux). I will show how to read the signals in such power production curves, to determine cloud cover on a given day, and to detect solar eclipses. Finally, I use these measurements to estimate the "carbon footprint" of the August 21, 2017 solar eclipse.

1:20 – 1:35 Identifying the Practices Associated with Computational Introductory Physics

Michael J. Obsniuk, Kettering University
mobsniuk@kettering.edu

Given the complexity of many modern research questions, computation is playing an increasingly important role in the STEM fields. Accordingly, the AAPT has made recommendations for including computation at the introductory physics level, focusing on the knowledge, skills, and tools of the trade. While many professionals from both industry and academia find this inclusion of computation to be important, researchers and instructors have not yet developed a solid understanding of how to implement it. This presentation focuses on current research involving the identification and classification of the common computational practices that show up in a problem-based computational introductory physics classroom at Michigan State University.

1:35 – 1:50 It's Not That You Said it, it's How You Said it: Exploring the Linguistic Mechanisms Underlying Values Affirmation Interventions at Scale

Nia Dowell, University of Michigan
ndowell@umich.edu

Psychological interventions, such as the values affirmation, have been shown to alleviate the male-female performance difference when delivered in the classroom, however, attempts to scale the intervention are less successful. This study provides unique evidence on this issue by reporting the observed differences between two randomized controlled implementations of the values affirmation intervention at scale, i) successful physics class implementation and, ii) unsuccessful online implementation. Co-presenters include Timothy A. McKay, Department of Physics, University of Michigan.

# Abstracts for Contributed Presentations (cont.)

1:50 - 2:05 A Demo Presentation from the UM Demo Lab

Monika Wood, University of Michigan
monikak@umich.edu

We will present a handful of exciting and informative demonstrations that were constructed in the University of Michigan Physics Lecture Demonstration Lab. We hope to inspire fellow physicists from the area that constructing apparatus that are useful in class can be done with a little know how and a lot of inspiration.

2:05-2:20 Scientific Practices in Minimally Completed Programs

Daniel Oleynik
oleynikd@msu.edu

Computational problem solving practices are beginning to be the center of many introductory physics courses. Specifically, within P-cubed, students regularly work on computational problems situated in physics that involve minimally working programs. Currently, very little research has been done on minimally working programs in relation to curriculum design, especially with how frequently they facilitate students in engaging with computational practices. After an initial coding of student work in class, we have identified extended periods of time where students were working on aspects of the problem that were not intended by instructors, which we coded as "distractors."

# Abstracts for Contributed Posters

Free Body Diagrams Beyond Free Body Diagrams

Michael C. Felski
michaelfaleski@delta.edu

The free body diagram is a tool used in virtually all introductory physics courses as a way to analyze force problems. One standard introductory approach is to put all of the forces acting at the center of the mass and perform a Newton's Second Law analysis. Does this help students get a physical sense of what is happening? Some thoughts on how to present/construct the free body diagram is described that may help put the physical back into the physics for students is presented. More examples of how this approach could be used are presented.

# Abstracts for Contributed Posters (cont.)

## Writing-to-Learn Activities in Introduction to Mechanics

Maya Chamra and Madhav Kumar
madhavkr@umich.edu

In the Introduction to Mechanics course at the University of Michigan, taken by over 600 students a semester, we have implemented a series of three Write-to-Learn (WTL) activities through a campus-wide initiative called M-Write. M-Write is a program with the intent of bringing WTL into foundational STEM courses. The goal is to reinforce the concepts being taught and better assess student understanding through writing. We will first describe the pedagogical theory behind the creation of our WTL activities and its associated successes. We will then discuss how this theory has been used to create the activities within our course. An important part of our presentation will focus on the process of executing this program. We will explain these topics through our experiences as Writing Fellows, particularly regarding our interaction with students and unique position as near-peer mentors.

## An Exploration into Student Conceptions of Systems through a Writing Activity

Rob Dalka
rpdalka@umich.edu

This study is an investigation into a series of 3 writing-to-learn (WTL) activities implemented throughout a full semester of an introductory physics course for engineers and scientists enrolling more than 650 students. These WTL activities involved students responding to a prompt that put them in a real world scenario with tangible questions. Each activity featured three parts; a First Draft, Peer Review, and Revised Draft. Both qualitative and quantitative analysis of the students' work will be employed to develop a richer picture of a student's evolution of understanding and possible sources of conceptual misinterpretations. Results of categorizing different modes of understanding will be presented through a topic modeling approach. The level of understanding and score students receive on these assignments will be compared to student performance in other aspects of the course.

## Understanding Boiling Points with Introductory E+M

Jordan K. Steckloff
jordan@psi.edu

The thermodynamics of phase changes is generally introduced macroscopically, with a liquid's boiling point presented as an immutable material parameter. However, this approach fails to explain why the boiling points of some materials are much higher than others, or why materials remain in a condensed liquid state at all. Here I present a conceptual method for understanding how a liquid's boiling point is determined by the electromagnetic forces holding molecules together.

# Abstracts for Contributed Posters (cont.)

Densities of Extra Solar Planets

Alex Alajbegovic
lopresto@umich.edu

Most of the exoplanets discovered by the Kepler mission were detected by the transit method, which gives us the radius of the planet. Use of the radial velocity method has also yielded the mass of a number of them, which allows densities to be calculated as well. Plots of the densities vs. radius and radius vs. mass of these planets will be presented and comparisons with the densities of the planets in our own solar system to planets considered, based on their radii, to be of similar types will be made.

Advancing Equity and Inclusion in STEM

Israa Ali, Tania Zaragoza, and Mairna Askar
aliim@umich.edu, ztania@umich.edu, mairna@umich.edu

From the findings in Richard M. Ryan and Edward L. Deci's Self Determination Theory, our research team is focusing on the three aspects that have significance on a person's performance in STEM. It has been proven that through competence, autonomy, and relatedness, there is an enhancement in intrinsic motivation, self-regulation, and well-being. These factors have a strong psychological influence in all human activities, including education. We have conducted focus group interviews with students in introductory STEM courses to pinpoint the impact of these courses on their self determination, perception and accessibility to STEM, with a focus on females and minorities.

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## Updates or Changes