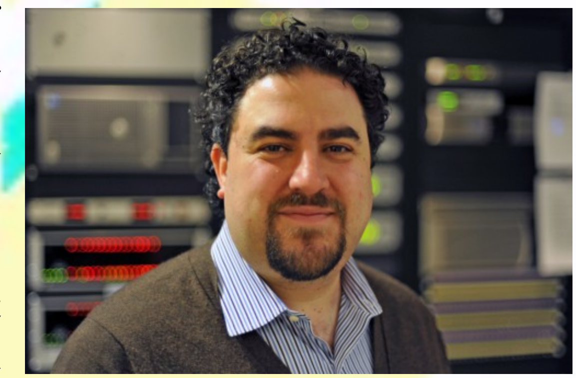
Michigan Section of the American Association of Physics Teachers

Spring 2014 Meeting
Announcement and Program Schedule

Western Michigan University, Kalamazoo, MI
April 12, 2014

Program Highlights



We are pleased to welcome Dr. Justin Kasper as our featured speaker. Justin Kasper is a Professor in the Department of Atmospheric, Oceanic and Space Sciences at the University of Michigan and a Research Associate of the Smithsonian Astrophysical Observatory. Justin designs sensors for spacecraft that explore extreme environments in space from the surface of the Sun to the outer edges of the solar system. He is interested in understanding the forces that lead to solar flares and the solar wind, a stream of particles heated to millions of degrees in the Sun's atmosphere, or corona. His major results concern heating, instabilities, and helium in the solar corona and solar wind, and the impact of space weather on society. He has served on advisory committees for NASA, the National Science Foundation, and the National Academy of Sciences. He currently leads the SWEAP Investigation, an international team of scientists and engineers building sensors that will collect samples of the Sun for the NASA Solar Probe Plus spacecraft.

Door Prizes!!!

We have some great door prizes donated by Orion and PASCO and distributed during the afternoon session, see the schedule below. These prizes include a pair of 15 X 70 astronomy binoculars and some fun lab and demo equipment, so you will want to be there for the drawing!

Program Overview

Location: Referring to the map attached to the end of this schedule, the meeting will be held in 1104 Rood Hall, marked as Rood in the center right of the second map. Additional directions to the University can be found at https://www.wmich.edu/visit/directions Printable Maps of the university can be found at https://www.wmich.edu/maps/printables.php

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

Parking: Again referring to the provided map, parking will be available in the lot 61 just off Rankin and right next to the Everett Tower.

Lunch: Jimmy John's Submarine Sandwich lunches will be available for $10.00 per person, separate from the registration fee. Members will able to pay and make their selections during morning meeting registration. The choices for a sandwich are smoked ham, roast beef, tuna, turkey, salami, or vegetarian. Also, customers will have the choice of chips and a cookie. The drink option will be between pop and water.

Also, refreshments will be available throughout the meeting courtesy of WMU Physics Department. The refreshments include the following items: bagels, donuts, fresh fruit, orange juice, bottled water and coffee (regular and decaf).

Hotels: A list of local hotels can be found at https://www.wmich.edu/visit/hotels

Program Schedule – Saturday, April 12th

7:30 – 8:00 am **Registration/Morning Refreshments**
Meeting fee: $10.00 (FREE for students and first-time attendees)
Location: Southwest Entrance to Rood Hall

8:00 – 8:15 am **Call to Order and Welcome**
Scott Cochran, Kirtland Community College – MIAAPT President
Location: 1110 Rood Hall

8:15 – 11:30 am **Contributed Presentations**
Location: 1110 Rood Hall

8:15 – 8:30 **Inquiry-Based Physics 2 Lab: Experiments and Assessment**
Matthew Gonderinger, University of Detroit Mercy *(physicsgondo@outlook.com)*

8:30 – 8:45 **Focus on Lenz's Law**
Laurence Tarini, Grand Valley State University *(tarinil@gvsu.edu)*

8:45 – 9:00 **How Students Choose Visual Representations when Solving Charge Distribution Problems**
Alanna Pawlak, Michigan State University *(pawlakal@msu.edu)*

9:00 – 9:15 **Using Musical Intervals to Demonstrate Superposition of Waves and Fourier Analysis**
Michael C. LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

9:15 – 9:30 **Phoning It In: Using Skype For Lectures**
Philip Edward Kaldon, Western Michigan University *(philip.kaldon@wmich.edu)*

9:30 – 9:45 **Rethinking Textbooks in a High School Physics Class**
Steve Dickie, Divine Child High School *(falconphysics@gmail.com)*

9:45 – 10:00 am Break

10:00 – 10:15 **Introductory Students' Mechanistic Reasoning when Answering Conceptual Problems**
Leanne Doughty, Michigan State University *(ldoughty@msu.edu)*

10:15 – 10:30 **Learning about Modeling Instruction for Teachers and Teachers of Teachers**
Beth Kubitskey, Eastern Michigan University *(mkubitske1@emich.edu)*

10:30 – 10:45 **Terminological Issues in Physics Teaching: What our Students Need to Know**
Rex Taibu, Western Michigan University *(rex.taibu@wmich.edu)*

10:45 – 11:00 **What Is *g*, Actually?**
Alan Grafe, University of Michigan-Flint *(grafe@umflint.edu)*

11:00 – 11:15 **Solving Kinematic Problems Mentally from Basics by Conceptual Story-Logic**
David Schuster, Western Michigan University *(david.schuster@wmich.edu)*

11:15 – 11:30 **Learn, Search, and RE-Search**
Ayana Ghosh, University of Michigan-Flint *(ayanag@umflint.edu)*

11:30 – 1:00 pm Lunch

1:00 – 2:00 pm **Keynote Address:**
Physics of the Solar Corona and Our First Mission to the Sun
Dr. Justin Kasper, Atmospheric, Oceanic, and Space Sciences,
University of Michigan-Ann Arbor *(nrenno@umich.edu)*
Location: 1110 Rood Hall

Just four years from now, in 2018, an international team led by NASA is poised to make history with the launch of the *Solar Probe Plus* spacecraft. A sequence of seven close encounters with the planet Venus over five years will reduce the angular momentum of the spacecraft enough to allow it to plunge into the corona or outer atmosphere of our Sun. For the first time we will be able to collect direct measurements of conditions within the corona, allowing us to answer fundamental questions about the Sun including why the corona is millions of degrees hotter than the surface of the Sun, and how the corona produces a supersonic wind of plasma that flows through interplanetary space. This talk will explore the physics of the *Solar Probe Plus* mission, from the basic mysteries of the solar atmosphere to the technical challenges faced by a spacecraft this close to the Sun. An emphasis will be placed on the role concepts such as pressure, temperature, gravity, angular momentum, and magnetic fields play in this mission, as real world examples of physics encountered in the classroom.

2:00 – 2:30 pm **Poster Session and High-School Photo Contest**
Location: Southwest Entrance to Rood Hall

2:30 – 3:00 pm **Puzzlers! And Door Prizes!**
Location: 1110 Rood Hall

3:00 – 3:30 pm **MIAAPT Business Meeting**
Location: 1110 Rood Hall

3:30 –5:30 pm **Workshops**

Workshop #1

Integrating Core Ideas and Scientific Practices into Introductory Physics
James T. Laverty, Michigan State University *(laverty1@msu.edu)*
Location: 2275 Rood Hall

Michigan State University has recently formed groups of faculty members to improve its introductory physics courses. These groups are tasked with developing a shared vision for the introductory courses and assessing the effectiveness of the curriculum. To frame these discussions, the department convened meetings of interested faculty to determine the core ideas and scientific practices that they felt were at the core of introductory physics courses. This workshop will present the framework for these discussions and will work through that framework, starting at the core ideas and practices and ending with items that can be used in the classroom.

Workshop #2

Series and Parallel Connections Activity for Resistors and Capacitors
Michael C. Faleski, Delta College (michaelfaleski@delta.edu)
Location: 2271 Rood Hall

The connection of resistors and capacitors in series and parallel is a problem common to all textbooks. It seems that it is often taken for granted that students understand how to make connections of circuit elements into either series or parallel, but experience shows that when confronted with putting an ammeter(series) or voltmeter(parallel) into a circuit, it is not done correctly much of the time. This activity is meant to address the idea of how to connect resistors (capacitors) into series and parallel, how to calculate the resulting equivalent resistance (capacitance), and how to write the connections made with a picture into words. There is a simple and surprising (to the students) relationship that is discovered when the connections are put into words. Discussion will also include how to get students to be able identify parallel and series connections in theory from a schematic circuit diagram.

Abstracts for Contributed Presentations

Inquiry-Based Physics 2 Lab: Experiments and Assessment
Matthew Gonderinger, University of Detroit Mercy *(physicsgondo@outlook.com)*

Fifteen years ago, the University of Detroit Mercy began to implement an inquiry-based active learning curriculum in its second semester general physics laboratory courses. I will give an overview and examples of the experiments utilized. I will also discuss the results of a multi-year assessment of this curriculum at UDM using the Determining and Interpreting Resistive Electric Circuit Concepts Test (DIRECT) assessment developed at North Carolina State University. UDM students in the algebra-based physics sequence have performed similarly to students in the original DIRECT study while students in the calculus-based sequence have performed significantly better.

Focus on Lenz's Law

Laurence Tarini, Grand Valley State University *(tarinil@gvsu.edu)*

I present a quick-and-easy way for students to apply Lenz's Law to find the direction of the current induced by electromagnetic induction.

How Students Choose Visual Representations when Solving Charge Distribution Problems

Alanna Pawlak, Michigan State University *(pawlakal@msu.edu)*

In physics, we create simplified models of physical systems, which can be presented visually through representations. Often, there are multiple representations available to illustrate the same model. While they may appear different superficially, it is important that students recognize that each illustrates the same model, and that they are able to determine in which situations a particular representation may be most productive. We observed students completing an activity requiring them to choose a representation of a charge distribution in order to answer questions and to justify their choice. We present preliminary results from analysis of a small number of videos.

Using Musical Intervals to Demonstrate Superposition of Waves and Fourier Analysis

Michael C. LoPresto, Henry Ford Community College *(lopresto@hfcc.edu)*

A description of a demonstration of superposition of waves and Fourier analysis using a set of four tuning forks mounted on resonance boxes and oscilloscope software to create, capture and analyze the waveforms and Fourier spectra of musical intervals.

Phoning It In: Using Skype For Lectures

Philip Edward Kaldon, Western Michigan University *(philip.kaldon@wmich.edu)*

The Long Michigan Winter of 2014 provided us with multiple snow days – and a number of days when travel was impossible even if the university was open. Having anticipated this, I have used Skype video sessions to with some success and some failures to do lectures from home.

Rethinking Textbooks in a High School Physics Class

Steve Dickie, Divine Child High School *(falconphysics@gmail.com)*

I hate textbooks! Most high school students never look in them except to find the homework problems. In the end they end up being really expensive problem sets. Is there a better way? I'll share my efforts to replace my textbook with a workbook printed through a print-on-demand service supplemented by interactive iBooks with some content I've created and some I've taken from Open Educational Resources.

Introductory Students' Mechanistic Reasoning when Answering Conceptual Problems

Leanne Doughty, Michigan State University *(ldoughty@msu.edu)*

In physics we rely on mechanisms to explain natural phenomena. Explanations that include mechanistic reasoning explain the process by which a cause brings about an effect. Constructing these types of explanations of phenomena is a central part of authentic science and supports meaningful understanding of correct ideas. Students' ability to answer conceptual problems correctly may depend on their ability to reason mechanistically about the phenomena involved. We have investigated this idea by analyzing group discussions using a mechanistic reasoning framework for groups that answered correctly and incorrectly about the movement of a charge given an electric field vector representation. Co-authors: Alanna Pawlak, May Lee, and Marcos D. Caballero.

Learning about Modeling Instruction for Teachers and Teachers of Teachers

Beth Kubitskey, Eastern Michigan University *(mkubitske1@emich.edu)*

Oakland Schools, in collaboration with the Michigan Mathematics and Science Network and Eastern Michigan University, received a MDE MSP grant to both provide professional development opportunities for physics and chemistry teachers to participate in 3-week summer modeling workshop and provide information to university science methods faculty about modeling. Additional deliverables include developing materials to be used in methods courses to expose future teachers to modeling philosophy. This short presentation will share the information about the opportunities and recruit participants.

Terminological Issues in Physics Teaching: What our Students Need to Know

Rex Taibu, Western Michigan University *(rex.taibu@wmich.edu)*

Definitions of physical concepts are very vital in our teaching and scientific communication. Definitions, terms, phrases, or diagrams are not "concepts" themselves, but mere "concept representations". In other words, scientific ideas exist outside the words or diagrams used to represent them. In this presentation, I will share ways in which teachers can introduce concepts in way that does justice to the distinction between "ideas" and various modes of representing them. These include, introduction of concepts in a way that avoids complex terminology at the beginning (Arons, 1983), explicit acknowledgement of language difficulties to students (Flodin, 2009), paying attention to everyday vs. scientific meaning of a given term (Gee, 2004), use of terms in multiple physical contexts (Touger, 1999), and advocacy for contextual interpretation of meaning (Hutten, 1948). These potential solutions to terminological issues will be discussed in light of polysemous terms "weight", "weightlessness" and "free fall". Co-presenter: Dr. David Schuster

What Is *g*, Actually?

Alan Grafe, University of Michigan - Flint *(grafe@umflint.edu)*

When analyzing a problem involving Newton's Second Law when gravity is present, many students will insist that the acceleration of the object is 9.8 m/s^2, regardless of the presence of other forces that may change this value. Some of this problem seems to be due to a lack of understanding of what g actually represents. This presentation discusses an attempt to remedy this situation but re-sequencing the introduction of the concept of gravitational field and by using non-traditional (but still SI) units for g.

Solving Kinematic Problems Mentally from Basics by Conceptual Story-Logic

David Schuster, Western Michigan University *(david.schuster@wmich.edu)*

Can you solve uniform acceleration kinematic problems in your head in 20 seconds or less, from the concept meanings of speed and acceleration, via physical insight 'story-logic'? I.e. from basics rather than plugging into derived "equations of motion". Here is a simple example to try both ways as a basis for discussion of the method and its merits. Compare thinking modes too! *Problem:* (a) A stone is projected upward at 30 m/s. How high does it go? Take gravitational acceleration as 10 m/s^2. (b) In general if initial speed is *doubled* what happens to height reached, and *why?*

Learn, Search and RE-Search

Ayana Ghosh, University of Michigan - Flint *(ayanag@umflint.edu)*

Physics is one of the basic sciences that demands hands-on research to develop a better understanding of the subject. Most of the high school students do some sorts of research projects as part of their course curriculum. But there is indeed a huge difference when it comes down to performing actual research work leading to new scientific results. In this presentation, I would share my experiences in doing research during past three academic years, both in-state and out-of-state. This would also include the concerns, difficulties and opportunities related to the process of undergraduate research and beyond.

Abstracts for Contributed Posters

Integrating Practices and Core Ideas into MSU's Introductory Physics Courses

James T. Laverty, Michigan State University *(laverty1@msu.edu)*

The current curriculum in most introductory college physics classes nationwide centers almost exclusively on content knowledge. Recent national publications have called for an integration of scientific practices (e.g. Construct and Use Models) into the curriculum to teach students the process of science as well. At Michigan State University, we are working with faculty to incorporate practices into the introductory physics courses. As part of this process, we are developing assessment items that integrate both the practices and core ideas of introductory physics. These items will be used as a stepping-stone to develop curricular changes in the courses as well.

It's "Just Math": A New Epistemic Frame

Steven Wolf, Michigan State University *(wolfste4@msu.edu)*

Physicists use mathematics as a tool to model physical phenomena. Students learn to use mathematical tools (e.g, vector calculus and Taylor series) in their physics courses, but often struggle to employ them in novel situations. We reviewed video of students solving physics problems in interview and group settings. We identified patterns of student behavior and discourse that we are calling the "Just Math" epistemic frame. A specific epistemic frame can be described as the network of activations and inhibitions of resources in response to a person's current activity. Transitions into and out of the Just Math frame are both obvious and abrupt. Furthermore, these transitions appear universal, inevitable, and predictable.

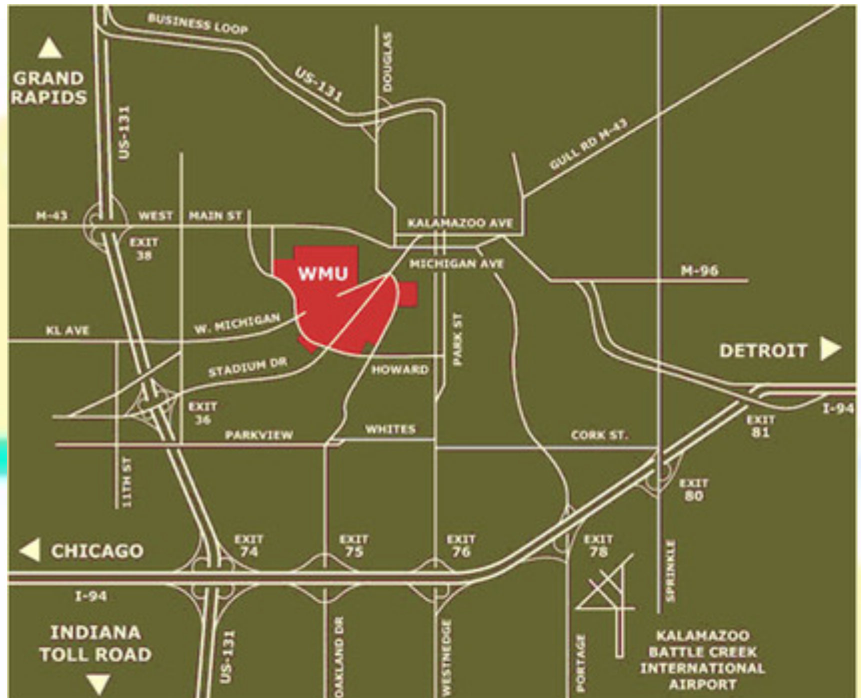
How students choose visual representations when solving charge distribution problems

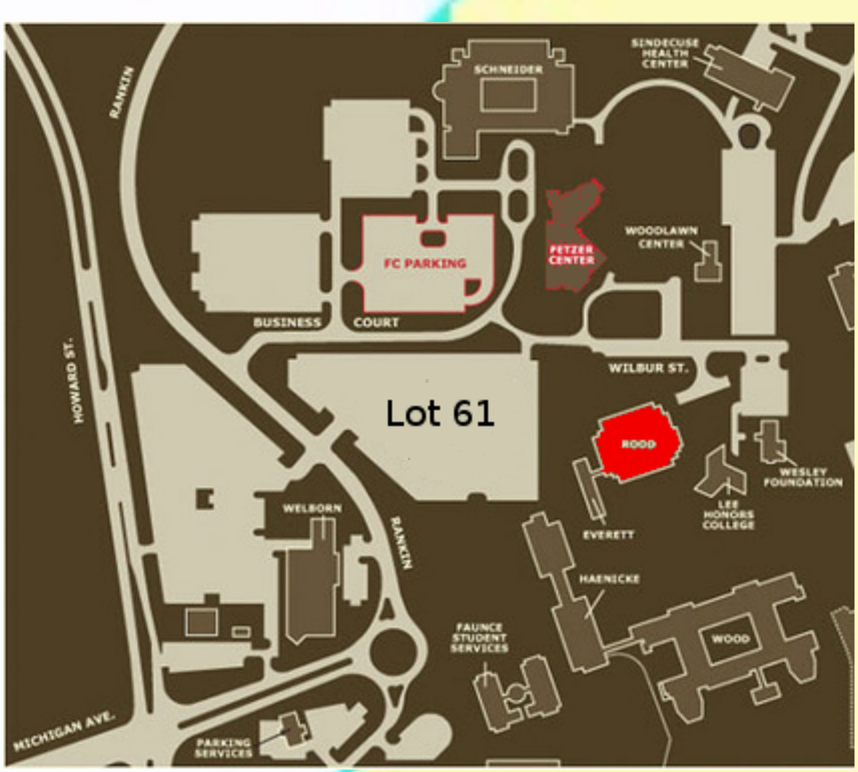
Alanna Pawlak, Michigan State University *(pawlakal@msu.edu)*

In physics, we create simplified models of physical systems, which can be presented visually through representations. Often, there are multiple representations available to illustrate the same model. While they may appear different superficially, it is important that students recognize that each illustrates the same model, and that they are able to determine in which situations a particular representation may be most productive. We observed students completing an activity requiring them to choose a representation of a charge distribution in order to answer questions and to justify their choice. We present preliminary results from analysis of a small number of videos.

MIAAPT Mission Statement: The Michigan Section of the American Association of Physics Teachers is dedicated to promoting excellence in physics education in the state of Michigan and to supporting physics educators statewide. This organization shall endeavor to advance the knowledge of physics, to improve the teaching of physics, and to interest an increasing number of young people in making a career of physics.

Campus Maps





Rood Hall is marked in red in the map above.