Abstracts for Breakout Sessions at the October 26, 2013 Workshop

11:00 **Using NASA Materials in the Classroom** *Tom Brestel, Judy Stucky*

This session will show you how to make simple rockets in the classroom. These rockets will be much safer than the traditional "two liter bottle" rockets of the past and can be constructed of paper in just a few minutes. If time permits we will also give you a summary of what NASA has been up to after the Space Shuttle program has been cancelled.

11:00 **Discussion: Preparing Science Teachers** T*odd Young*

What is the best way to prepare a science education student who will have to teach physics? Should the focus be on conceptual understanding? Should the focus be on problem-solving techniques? Should breadth or depth be emphasized? What is the best pedagogy for today's science student and educator? Should these future educators by required to pass standardized advanced high school physics exam prior to being allowed to teach it? Please feel free to share your answers to these questions as this breakout session discusses them.

11:00 **Jigsaw Activities** T*ravis Lund, Marilyn Stains*

"Jigsaws" are learning activities that divide students into groups, with each group focused on learning a different concept or skill. The students are then shuffled into new groups in which each student is an "expert" in a different area. Together, they solve a problem that no single student has the skills to solve alone. Jigsaws thus allow students to engage content actively, practice collaboration and communication skills, and model the way that science, engineering, and medicine work in the real world. Jigsaw activities have been successfully implemented in science classrooms ranging from middle school to the undergraduate level.

Attendees in this session will learn about the goals and design of Jigsaw activities, and will participate in a Jigsaw activity in order to experience it from the students' perspective. You will also receive an overview of existing Jigsaw activities in biology, chemistry, physics, astronomy, and environmental science that are available online.

11:00 **The Citizen Astrophysicist** *Beth Willman*

Terabytes of astronomical data are now publicly available in formats accessible to both laypeople and experts. These public data bring research-based inquiry and the possibility of astronomical discovery to anyone willing to jump in. I'll briefly highlight a few ways to connect students and teachers (middle school to advanced undergraduate level) to studies of galaxies using these public data, with focus on the Milky Way. I'll offer a few curated activities using online Milky Way images, Galaxy Zoo, and the public Sloan Digital Sky Survey database. We'll then have workshop time to begin exploring the activity that is most aligned with each individual's interest.

11:30 **Using Learning Catalytics** *Chad Brassil, Tina Riley*

Learning Catalytics is a ground-breaking web-based technology. It allows peer instruction (clickers) with a variety of mobile devices eliminating the need for students to purchase a clicker. It has many more question types built in than the multiple choice question of standard peer instruction – indicating a position on a graphic, drawing a functional relationship, etc. or the choice to copy and use any shared questions created by other instructors using the system. It has advanced features for controlling student interaction such as using seating maps to coordinate discussion between students and their peers. It can be obtained with any Pearson Mastery product and will likely be a highly influential product.

11:30 **Using an IR Camera** *Cliff Bettis*

A number of classroom demonstrations will be shown using a FLIR infrared camera. A number of classroom demonstrations will be shown using a FLIR infrared camera.

11:30 **The Value and Limitations of Models in Science** *Wendy Adams*

At the University of Northern Colorado our Teacher preparation program for pre-service elementary teachers includes a capstone course entitled Principles of Scientific Inquiry – Finding Order in Chaos. The overarching learning objectives for the course include understanding what it means to "do science" and to provide ideas about how to teach this explicitly. One of the sub-objectives of "doing science" relates to models – what are different types of models and what makes them useful. In this presentation I'll describe how this objective is integrated throughout the course and, as a group, we will work with one specific activity. This activity uses everyday hands-on materials and graphical models to predict earthquakes.

11:30 **Sloan Digital Sky Survey Online Labs** *Lee Powell*

This session will introduce participants to the labs available on the SDSS website. The labs fall in two categories, called "basic" and "advanced" projects. Participants will be shown the difference between the two levels through two labs using real spectroscopy to identify types of stars. Handouts will be provided listing all of the available labs, URL's, and specific parts of the labs to be discussed in the session.

12:00 **Taking Lab Data with Mobile Devices** *Kendra Sibbernsen*

A pilot class of the first semester of algebra-based physics lecture and laboratory was offered completely online at MCC this fall. The laboratories used inquiry-based activities that uses the sensors in their own smart phones or tablets, such as the video camera for measuring motion, the microphone for measuring frequencies, and more. At this session, you will have the opportunity to try a few of the apps on the iPad2 that were used to take lab data for this class. You will also have time to discuss possible uses for using mobile devices to take data in your classes.

12:00 **Mastering Physics** *Eric Olson*

This session will introduce you to MasteringPhysics™, the most advanced and widely used online Physics tutorial and homework system available. Learn how Mastering can save you time, give you valuable insight into your class' performance, quickly identify students at risk, help prepare your students for class allowing you to spend your time in lecture more effectively, and much more.

12:00 **Exoplanet Transits: Pedagogy & Citizen Science** *Adam Jensen, Ethan Van Winkle*

The knowledge of any planets outside of our own Solar System is barely two decades old. Yet in 2013, we now know of several hundred exoplanets, with thousands of additional likely "candidates." The transit method of detecting exoplanets is arguably the technique most responsible for the dramatic increase in known planets over the last decade, having detected a significant fraction of "confirmed" exoplanets and the vast majority of "candidates" through the space-based, dedicated transit mission Kepler. In addition to being a cutting-edge scientific topic that inspires students and instructors alike, the very nature of exoplanet detection is a rich topic that lends itself to a deeper discussion of the scientific method. Transits specifically highlight the indirect, inferential nature of much of astronomy, as these more or less literal "shadows" reveal the presence of planets that cannot be directly imaged with current technology. We will briefly discuss the science behind exoplanet detection, highlighting transits and ways to connect exoplanets to a broader understanding of the scientific

method. We will then discuss Planet Hunters, a citizen science project under the Galaxy Zoo umbrella, where users examine real Kepler data, looking for transit events.

12:00 **Scale Height** *Hari Arunachalam, Kevin Lee, and Dominic Ryan*

Scale Height is a parameter used to describe how something fades away with increasing distance – H is the distance over which a quantity decreases by a factor of 1/e. It is most commonly applied to planetary atmospheres, but does appear in other contexts (e.g. the distribution of stellar populations with respect to the disk of the Milky Way). This session will expose attendees to some early versions of HTML5/Javascript computer simulations for working with scale height. These materials were designed for physics and astronomy students with a little mathematical sophistication (e.g. knowledge of exponential functions) and are not appropriate for the introductory descriptive astronomy student.

Abstracts for Longer Hands-on Sessions at the October 26, 2013 Workshop

2:30 pm **PheT Ineractive Simulations for the Classroom** *Wendy Adams*

PhET Interactive Simulations are a suite of over 120 physics, chemistry and some biology and earth science simulations which are research-based and student-tested. Simulations help students visualize difficult to understand concepts; allowing students to interact with various parameters encourages discovery of cause and effect relationships which help students build a mental framework about the concepts. Students can then use this basic framework coupled with other activities or lecture to help construct a more complete understanding of the concept. During this workshop we will discuss different ways to use simulations in your classroom including lecture, individual or small group inquiry activities, homework and lab. Examples of activities that can be done around the sim as well as results of a recent PhET as homework study will be discussed. Participants will then explore the sims and discuss their classroom ideas in small groups.

2:30 pm **Fruitty Batteries & Squishy Circuits** *Marina Bradaric, Steve Wignall*

This workshop will look at innovative ways to explore the concepts underlying electric circuits with common materials. These will include making batteries out of lemons and designing circuits using playdoh as conductors and insulators. These tools are appropriate for the classroom and outreach.

2:30 pm **Sound & Music** *Tina Riley, Darvy Ceron, Patrick Wilcox, Lauren Wolterman, Marina Bradaric, Ethan Van Winkle, & Kevin Lee*

This session will focus on waves, sound, hearing, hearing damage, standing waves and musical instruments, Doppler shift, and Beats. It will be taught primarily through exposure to resources of use in the classroom: hands-on demonstrations, simulation and video usage, web resources, and extensive curriculum useful at multiple levels written by Wendy Adams (University of Northern Colorado, former educational officer for the Acoustical Society of America).