**Abstracts for Breakout Sessions at the October 6, 2018 Workshop**

10:30 **Phantastic Photon: Colors & The Physics of Light Using Light Emitting Diodes (Make & Take)**

**Tom Brestel, Holdrege High School, NE, Judy Stucky, Westside High School, NE**

This will be a review of some of the simpler topics of quantum theory. You will make and use LED sticks to determine the relative energies of different colors of light both qualitatively and quantitatively. LED sticks are made from tongue depressors and light emitting diodes and are classroom friendly tools that allow students to study the physics of light.

10:30 **The Rotating Sky** Kent Reinhard, SECC

How to describe the sky? There are a variety of ways to help students envision the motions of the sky. This session will make use of the Horizon Globe model and the Rotating Sky Simulator. Participants will have the opportunity to work hands on with a Pro and SE Horizon Globe model. They will also have the ability to bring up the Rotating Sky Simulator and see how the simulator setting can be integrated with the physical model.

10:30 **Water & Climate on Mars** Mindi Searls, UNL

The climate of Mars has shifted dramatically since formation from a warm and wet oasis to a modern day desert with intermittent ice ages. How has the climate changed over time? Why does Mars undergo periodic ice ages? How do we know anything about these matters? In this session participants will learn about the history of climate on Mars through a series of hands-on activities.

10:30 **Cooperative Group Problem Solving in Physics** *Steve Ducharme, UNL*

Workshop participants will learn about the "Cooperative Group Problem Solving in Physics" a student-centered learning method developed by the Physics Education Group at the University of Minnesota. This method teaches students to become expert problem solvers by working in groups of three or four while focusing on the following essential feature of problem solving: 1) Focus on what is going on in the problem; 2) Describe the relevant physics principles; 3) Plan a solution; 4) Execute the Plan; and 5) Evaluate the solution for completeness, reasonableness, and consistency. After a brief overview of the design and pedagogy of the method, participants will be guided through a sample "Group Problem Solving" exercise. Participants can learn more about this method at the following web page: http://groups.physics.umn.edu/physed/Research/CGPS/GreenBook.html

11:00 **Updating Objectives and Outcomes of a Traditional High School Astronomy Class to meet Nebraska College & Career Ready Science Standards**

Presented by Dr. James Blake, K-12 Science Curriculum Specialist in LPS and high school astronomy teachers from LPS

With the adoption of the 2017 Nebraska College & Career Ready Science Standards, some traditional classroom approaches that may have focused more on memorization of facts have shifted to figuring out. These changes demand a new type of learning objective and professional learning considerations for beginning and veteran teachers alike. Join in the conversation with a team of LPS teachers and curriculum administrators - for a sneak peek into the preliminary process of one of the early attempts to implement these standards in a Lincoln Public Schools high school Astronomy class. Please bring your thoughts and ideas as we would like to make you part of the transition process- especially those working in the field of higher education or professional astronomy.

11:00 **BLUE MARBLE MATCHES - Using Earth for Planetary Comparisons**
*Michael Edmundson, Millard South High School*

This activity is designed to introduce students to geologic processes on Earth and how to identify geologic features in images. It will also introduce students to how scientists use Earth to gain a better understanding of other planetary bodies in the solar system.

11:00 **An Acoustic Whirligig** *Cliff Bettis, UNL*

I will show a sound driven whirligig that I like to think of as an acoustic version of Feynman's "Inverse Sprinkler". I will discuss the different acoustics of Helmholtz resonators and pipes and the underlying physics that explains the difference. I will use a spectrum analyzer to show the difference.

11:00 **Introducing an Online Ranking Task Editor** *Chris Siedell, UNL* *Brandon Harper, UNL*

Ranking tasks -- questions in which students order a set of items -- have been shown to be effective in improving learning. This session introduces a new tool being developed at UNL to create and share interactive, online ranking tasks. Participants will learn how to make their own ranking tasks, which students will be able to use on their smartphones. This work is made possible by funding from the NASA Nebraska Space Grant.

11:30 **Interactive Brainstorm: Classroom Uses of the DIY Zooniverse Project Builder Tool & What Support Resources are Needed** *Laura Trouille, Adler Planetarium*

In July 2015 we launched the free DIY Zooniverse Project Builder interface (zooniverse.org/lab) which enables anyone to build their own online citizen science project for free in a matter of hours. Among the 1000+ projects built to date, a few high school and college instructors have used this tool to build their own project (or have their students build projects) to support student learning about the science, data, and/or crowdsourcing. In this interactive brainstorm, we'll explore how you might use this Project Builder tool in your classroom and what additional resources/support we at Zooniverse should be providing.

11:30 **Capabilities of the Armillary Sphere** *Emily Welch, UNL*

When we look up at the night sky it appears that all of the stars and other celestial bodies are equidistant from us and on the surface of a dome that rotates about an axis. Even though we know that this celestial sphere model is not an accurate representation of celestial mechanics it is a good representation of what we see from here on Earth. The Ptolemaic Armillary sphere is a celestial sphere model that puts the observer at the center and illustrates what we see from Earth. It is useful in discussing many aspects of celestial mechanics including the positioning of the Sun, Moon and, planets, the effects of latitude, and illustrating various astronomical principles. During this breakout session, we will be using the Horizon Globe PRO, a fully adjustable Ptolemaic Armillary sphere, and discussing some of its applications in teaching astronomy including demonstrating the diurnal vs. annual motions of the sun, moon phases and the positions of planets. The Astronomy Education group at UNL is working on a series of videos that will demonstrate various astronomy concepts with the Horizon Globe PRO.

11:30 **Nano/STEM kits** *Terese Janovec, NCMN Outreach Students*

In this presentation participants will learn how to support learning in the classroom around nanoscale science, technology, and engineering topics. Using a variety of methods and tools which include Nano/STEM kits developed by the National Science Foundation participants will explore how to engage students in scientific principles. These kits contain hands-on activities, programs, digital downloads complete with resources on getting started, posters, lesson plans, supply lists, marketing materials, training, multimedia files, and more related to chemistry, physics, and engineering areas. Kits can be adapted for different ages and contain reuseable hands-on activities.

11:30 **Discussion: Why the Big Bang Was Not the Beginning** *Adam Davis, Wayne State*

The Big Bang theory is a tremendously successful model for explaining the observed cosmos. Indeed, it is really the only viable model currently available. But, it is not uncommon for us to overstate the initial conditions that Big Bang theory is based on or requires. There are some shortcomings of the Big Bang theory which necessitate some extensions to it. These theoretical extensions aren't quite as well established. Yet, it not uncommon today for the core theory and an extension to be all lumped together. This presentation will help you and help your students separate fact from theory from speculations.

12:00 **Interactive Astronomy Using Planetarium Software** *Todd Young, Wayne State College*

*There are various planetarium simulation software packages available, but how can you make them interactive and educational? This open discussion reviews best practices and lessons for different grade levels. One lesson -- "Motions in the Night Sky at Different Latitudes" will be discussed in detail.*

12:00 **Using 360° Videos** *Brandon Harper, UNL* *Marina Bush, LPS*

360-degree videos (stereo-vision animations that react to the viewer's perspective) have many benefits over standard educational videos in learning environments. This presentation describes 360-degree videos and their utility for teaching astronomy. One will briefly learn about the creation and workings of these videos and most importantly how to make use of them in the classroom. Useful sources of preexisting videos will be discussed and the materials and technology required will be outlined. A variety of teaching methods using 360-degree videos will be covered and demonstrated.

*12:00* **Using HTML5 Physics Simulations** *Robert Tabb, UNL*

Students take physics to better understand nature, but they often struggle to make connections between the equations they are taught and the real world. Yet nearly every one of them understands physics on an intuitive level: they can throw and catch a ball, ride a bike, and walk without slipping when it's icy out. By allowing students to interact with the physics they are being taught, we can improve their learning outcomes. In a classroom setting, this is often best done in the form of computer simulations which give students the tools to play with the concepts that they are learning in the classroom. This session will illustrate our usage of HTML5 simulations in our introductory physics recitation classes. We will describe many examples of these freely available computer resources to guide your students to a better understanding of the physics concepts that they are learning.

*12:00* **Funsize Physics** *Jocelyn Bosley, UNL* *Shireen Adenwalla, UNL*

(DISCLAIMER: Funsize Physics is not responsible for any minds that are blown.)

Condensed-matter physics is the hustler of the physics world. It is the science that gave us silicon transistors, MRIs, and solar panels. It is the reason your smartphone fits in your pocket, and why you may soon be able to fold up your big-screen TV and keep that in your pocket, too. But condensed matter physics is not just useful—it is also beautiful and awe-inspiring. Funsize Physics is an NSF-funded website developed to communicate the excitement, wonder, and potential of condensed-matter physics to a broad audience. In this session, we will explore the resources available on Funsize Physics, and consider how connecting fundamental physics concepts to cutting-edge research can enhance student learning.

**Abstracts for Longer Focused Sessions at the October 6, 2018 Workshop**

2:30 pm **Hands-on Workshop and Discussion: Classroom-based Citizen Science Research Experiences through Zooniverse**

Laura Trouille, Adler Planetarium

Through this hands-on, interactive workshop, you will have the opportunity to test drive the new infrastructure, tools, and curricular materials we have developed through our NSF-IUSE funded effort to bring Zooniverse-based research experiences into introductory astronomy courses for non-STEM majors. We will also showcase how to adapt the infrastructure and tools for use in other disciplines and course contexts (e.g., for use in high-school physics classrooms), taking advantage of the 80+ active projects on the Zooniverse site (see zooniverse.org/projects) as well as the free Zooniverse Project Builder interface (see zooniverse.org/lab). Finally, we will gather your feedback and advice for future directions and development effort in how to make these tools and resources as useful and impactful for your students and you.

2:30 pm **Using Astronomy Demonstration Videos**

*Emily Welch, Kevin Lee, & Lisa Pytlik-Zillig, UNL*

This project is developing a series of more than 40 videos centered on physical demonstrations that are ideal for use in introductory astronomy and physics courses. They can be utilized in the classroom, in homework and in distance education courses. Interactive materials accompany or are incorporated into many videos, consistent with the recommendations of educational research to maximize student learning from demonstrations. These videos are hosted on YouTube and on the Astronomy Education web site at the University of Nebraska, a site that is widely-used by astronomy educators. Workshop participants will be exposed to the underlying pedagogy of the videos and then experience them first in the role of the student and then in the role of instructor. This project is funded by NSF award #1245679.

2:30 pm **Overview of Nanotechnology**

*Terese Janovec, Steve Ducharme, & Anand Sarella, UNL*

The Nebraska Center for Materials and Nanoscience (NCMN) and the Nebraska Nanoscale Facility will present information about nanotechnology and some of the services and infrastructure the Centers provide throughout the Midwestern United States to transform advances in the fabrication, understanding, and utilization of materials, devices, and nanotechnology. Participants will tour a cleanroom and become familiar with the requirements and conditions of working in this type of environment. They will also learn about RAIN, a new system that supports analysis of materials remotely.