Abstracts – Spring 2007 MIAAPT meeting – March 17th, 2007 - GRCC

Harvey Leff's "What is Entropy?"

Thermodynamic entropy was introduced in 1865 by Rudolf Clausius. In 1877, Boltzmann discovered a remarkable definition of entropy in the context of statistical mechanics. Although both have enormous value and have withstood the test of time, they have failed as introductory teaching tools. Neither offers a satisfying elementary clarification of the physical significance and meaning of thermodynamic entropy. Further, most introductory physics textbooks miss the essence of entropy and, more generally, of thermodynamics itself. I shall begin with a discussion of why pure mechanics morphs into thermodynamics, as a physical system becomes less "ideal" and more "real." I shall then present a largely qualitative physical picture of entropy, with examples that are understandable at the elementary level and beyond. Space and time, two staples of physics, play fundamental roles. The proposed view shows why entropy's symbol S is remarkably (and fortuitously!) appropriate, and enables a meaningful answer to the title question, "What is entropy?"

Mandy Frantti's "Seeing the Invisible!"

What's out there in our universe? NASA has much to share. Participants will engage in a captivating hands-on activity, observing different wavelengths of "light" or electromagnetic energy and what can be used to "block" it. Most wavelengths can't be seen with the eyes, so how scientists detect it and how that information is being used will be the focus of the session. Examine ultraviolet, infrared, radio, and find out about the most exciting of all -- gamma rays and the distant universe! The activities can be done in a middle or high school classroom. (Brought to you by NASA using a GEMS guide for teachers.)

Mandy Frantti's "Gamma Ray Bursts: WOW!"

Participants will examine the amazing and powerful gamma-ray bursts--the highest energy explosions observed in the universe--with hands-on activities developed by NASA. Presenter will also provide participants with background information and an overview of what scientists are doing now with gamma-ray research. NASA materials provided.

Brad Ambrose & Natalie Beyer's "Tutorials in Intermediate Mechanics"

Presenters: Bradley S. Ambrose and Natalie Beyer, Department of Physics, 125 Padnos Hall, Grand Valley State University, Allendale, MI 49401; *ambroseb@gvsu.edu*

Abstract: Ongoing research in physics education has demonstrated that physics majors often do not develop a working knowledge of basic concepts in mechanics, even after standard instruction in upper-level mechanics courses.[1] This workshop will focus on *Intermediate Mechanics Tutorials (IMT)*, a suite of research-based materials developed by Ambrose and co-PI Michael C. Wittmann (U. Maine). These materials, modeled after *Tutorials in Introductory Physics*[2] and *Activity-Based Tutorials*,[3] form the focus of activities that are intended to supplement traditional lectures. The tutorials are designed to address persistent student difficulties and to guide students to make appropriate connections between the physics and mathematics. Workshop participants will learn about recent results from the research and obtain firsthand experience with selected tutorials. Because intermediate mechanics courses vary in format and content from institution to institution, we will also discuss how *IMT* can be tailored appropriately. A copy of all *IMT* materials, which include conceptual, derivation, and computer-based tutorials, will be granted to each participant.

1. B.S. Ambrose, "Investigating student understanding in intermediate mechanics: Identifying the need for a tutorial approach to instruction," Am. J. Phys. **72,** 453 – 459 (2004).
2. *Tutorials in Introductory Physics,* L.C. McDermott, P.S. Shaffer, and the Physics Education Group at the University of Washington (Prentice Hall, 2002).
3. *Activity-Based Tutorials, Volume 1: Introductory Physics,* M.C. Wittmann, R.N. Steinberg, and E.F. Redish (Wiley, 2004).

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