

NCS-AAPT

North Carolina Section of the American
Association of Physics Teachers

Program And Abstracts

13th Annual Spring Meeting

Davidson College

Davidson, NC 28035

April 4-5, 2008

EPITOME

NCS-AAPT Meeting – April 4-5, 2008

Friday evening, April 4

4:00-6:00	Registration	Dana Lobby
6:00-7:00	Banquet (Must have pre-registered with entrée choice)	Lilly Gallery (Chambers Bldg)
7:00-8:00	Invited Speaker – N. David Mermin (Cornell University, Emeritus) The Geometry of (Flat) Spacetime	Lilly Gallery Chambers Bldg
8:00-9:00	Reception and Social	Dana Lobby

Saturday, April 5

7:00-9:30	Registration	Dana Lobby
7:00	Coffee available	Dana Lobby
Session I	Chair: Tony Crider	Dana 146
8:00-8:15	J. D'Arruda (UNC Pembroke) Bringing Robotics into the Classroom	
8:15-8:30	D. Collins (Warren Wilson College) Observing Cataclysmic Variable Stars with a Small Telescope and CCD Camera	
8:30-8:45	S. Weatherford (North Carolina State) Consequences of Time-Steps: A Coffee Filter Activity	
8:45-9:00	W. Brandon (UNC Pembroke) On Instructional Laboratories Utilizing a Lock-in Amplifier	

9:00-9:15	M Hoover (UNC Pembroke) Using Magnetic Levitation to Enhance the Poisson's Spot Experiment	
9:15	Break	Dana 126
Session II		Dana 146
9:30	Invited speaker – Dr. Susana Deustua (Space Telescope Science Institute, Baltimore, MD) The Supernova Acceleration Probe (SNAP) Project	
Session III		Dana 127
10:15-11:00	Poster Session (Break refreshments available in Dana 126)	
Session IV	Chair: Bo Wessell	Dana 146
11:00-11:15	W. Christian (Davidson College) Symmetry Breaking on a Rotating Hoop	
11:15-11:30	J. Regester (Greensboro Day School) A School-Museum Partnership in Support of Classroom and Public Education	
11:30-11:45	K. Mamola (Appalachian State University) TPT in NC	
11:45-12:00	C. Bennett (UNC Asheville) Reflection Phase Shifts from Dielectric Surfaces	
12:00-12:15	A. Titus (High Point University) The Current Role of a Current Textbook	
12:15-12:30	J. Hubisz (North Carolina State University) Arguments Casting Doubt on the Role of Humans in Global Warming	

12:30-1:30	Lunch	Vail Commons
1:30-2:00	Business Meeting	Dana 146
2:00	Workshop Rocketry led by Doug Knight The Team America Rocketry Challenge Background and rules for the Team America Rocketry Challenge will be discussed.	Dana 111
3:00	Break	Dana 126
3:00	Workshop ComPADRE led by Susana Deustua	Dana 127

PROGRAM

Friday evening, April 4

- 4:00-6:00 Registration in the Dana Lobby
- 6:00-7:00 Banquet –Lilly Gallery, Chambers Building
- 7:00-8:00 Invited Speaker - **N. David Mermin**
(Cornell University, Emeritus)
The Geometry of (Flat) Spacetime
- 8:00-9:00 Reception and Social in the Dana Lobby

Saturday, April 5

- 7:00-9:30 Registration - Dana Lobby
- 7:00 Coffee available - Dana Lobby

- Session I** Chair: Tony Crider Dana 146
- 8:00-8:15 **Bringing Robotics into the Classroom**

J. D'Arruda (UNC Pembroke), University of North Carolina
Pembroke, Pembroke, NC, 28372, (910) 521-6423, fax (910) 521-6638,
email: jose@uncp.edu

As a teaching tool, robotics creates an environment that encourages students to: (1) Learn by inquiry and hands-on experimentation (2) Research and solve a real-world problem based on a Challenge (3) Learn how to write computer program which perform real-world tasks (4) Encouraging students to be designers and inventors (5) Build an autonomous robot using engineering concepts and (6) Present their research and solutions. We will discuss two programs which we are involved with using LEGO Mindstorm Robotic as a learning tool. One program involves over 300 middle school children who are actively learning science and the other involves a workshop for STEM teachers to be presented in June 2008. We believe that these activities could fundamentally change how students think about (and relate to) science, computers and computational ideas.

Support for these programs comes from NSF and the North Carolina Space Grant Consortium.

8:15-8:30

Observing Cataclysmic Variable Stars with a Small Telescope and CCD Camera *

D. Collins (Warren Wilson College), Asheville, NC 28815

A cataclysmic variable (CV) consists of a close binary star system. One of the stars has evolved into a white dwarf (WD), and the other is usually a red dwarf main sequence (MS) star. The close proximity of the WD to the MS star causes extreme tidal distortion of the MS star such that the outer envelope of the MS star is gravitationally pulled into the WD. This is equivalent to stating that the MS star fills its Roche lobe such that material “spills” over the inner Lagrangian point and falls into the WD. Angular momentum conservation causes the in-falling material to form an accretion disk around the WD. The resulting complicated physics provides a very rich area for undergraduates to explore – especially in general education courses. Many of these systems are observable with small telescopes and CCD cameras. With the orbital periods for these systems usually shorter than two hours, a single night’s observation run can provide an abundance of rich astrophysics. These systems often erupt sporadically due to instabilities in the accretion disks; “superhumps” develop in the light curves due to shock fronts forming in the accretion disks during eruptions; and eclipsing systems provide reliable means of determining the geometries of CV’s. General education (First Year Seminar) students have contributed to the observations and processing. This has been an excellent opportunity to enhance astronomy education through engaging observation activities.

*Partially supported by the American Astronomical Association Small Grants Program

8:30-8:45

Consequences of Time-Steps: A Coffee Filter Activity

S. Weatherford (North Carolina State University), Jon D.H. Gaffney and Karen Daniels, Department of Physics, Campus Box 8202, Raleigh, NC 27695-8202, Phone: (919) 513-7214, Email: saweathe@ncsu.edu

We will present a new group activity for introductory physics with a different take on the standard coffee filter lab. Students are presented with a task to use iterative calculations to determine the terminal speed of a coffee filter. The challenge: Students must do this by hand. The educational objective of the activity is for students to discover the sensitivity of interval size to the position and momentum calculations in

simulating a coffee filter's fall towards terminal speed. Some students first question their procedure for iterative calculation. After double-checking, they attribute unphysical results to error produced by a large time-step.

8:45-9:00

On Instructional Laboratories Utilizing a Lock-in Amplifier

W. Brandon (UNC Pembroke), University of North Carolina at Pembroke, One University Dr, Oxendine Science Bldng., Pembroke, NC 28372

Described herein are a few simple laboratory exercises illustrating the utility of both automated and non-automated phase sensitive detection schemes. The approach is intended to serve a dual purpose: to motivate the students to develop programs for instrument automation in the LabVIEW GUI environment and in addition, as is the primary focus of this talk, to motivate students to explore the fundamental operating principles behind a lock-in amplifier through the participation in well-designed laboratory activities.

9:00-9:15

Using Magnetic Levitation to Enhance the Poisson's Spot Experiment

Matthew Hoover (UNC Pembroke), Michael Everhart, Jose D'Arruda
University of North Carolina Pembroke, Pembroke, NC, 28372, (910) 521-6423, fax (910) 521-6638, email: jose@uncp.edu

In 1818 Fresnel proposed that light should be treated as a wave, not as a particle as was the accepted view of light since Newton. To show how absurd this idea was, Siméon Poisson, proposed that this would mean that if one places a solid sphere in front of a beam of light, instead of the sphere blocking the light and casting a shadow in back of the sphere, there would be a bright spot at the center, cause by the diffraction of the light wave around the sphere. We will investigate this diffraction pattern phenomenon known as the Poisson Spot using a HeNe laser and display a new and unique method which we have developed here at UNCP using a magnetic levitation device. The pattern will be projected onto a screen as well as directly onto a CCD chip. We will display and discuss our findings.

9:15

Break - Dana 126

Session II

Dana 146

9:30

Invited speaker – Susana Deustua

(Space Telescope Science Institute, Baltimore, MD)

The Supernova Acceleration Probe (SNAP) Project

The Supernova Acceleration Probe (SNAP) is a proposed space mission that will measure the anomalous acceleration of the universe by observing the luminosity distances and redshifts of Type Ia supernovae out to a redshift of $z=1.7$. Its focal plane array contains near infrared (HgCdTe) detectors and CCDs, 72 filters, and a field of view of 0.67 square degrees. It also has an integral field spectrograph.

SNAP's primary science goal is to understand the expansion history of the universe. In particular, observations of several thousand Type Ia supernovae (SNe Ia) with redshifts up to $z = 1.7$ will be used to determine the constant and time varying equation of state parameters w_0 to 0.05 and w_1 to 0.3. This specification places stringent requirements on the control of systematics and on the absolute color calibration of SNe Ia. Although SNe Ia are all nearly identical, their photometric properties vary with both time and redshift making an accurate global color calibration essential. In practice, a color calibration better than 2-3% over the wavelength range from 350 to 1700 nm is required.

Session III

Dana 127

10:15-11:00

Poster Session

(Break refreshments available in Dana 126)

Session IV

Chair: Bo Wessell

Dana 146

11:00-11:15

Symmetry Breaking on a Rotating Hoop

Wolfgang Christian and Ken Rathbun (Davidson College),
Department of Physics, Box 6926, Davidson, NC 28035-6926, Phone:
704-894-2322, wochristian@davidson.edu

A mass that is constrained to move on a rotating hoop is an excellent mechanical model of first- and second-order phase transitions. Although the minimum of the potential energy curve corresponds to the

bottom of the hoop at low rotation frequency, a spontaneous symmetry breaking (cusp catastrophe) occurs as the frequency is increased. We present the theory, a demonstration, and an Easy Java Simulation (Ejs) of this experiment. Additional Open Source Physics curricular materials and Ejs models are available from:

<http://www.opensourcephysics.org>.

Partial funding was provided by NSF grant DUE-0442581.

11:15-11:30

A School-Museum Partnership in Support of Classroom and Public Education

Jeff Regester (Greensboro Day School), Greensboro Day School, 5401 Lawndale Drive, Greensboro NC 27455, 336-547-7811 (home), 336-288-8590 (school), jregester@gmail.com

Abstract: Students at Greensboro Day School are building exhibits for use by the public at the Natural Science Center of Greensboro. The students learn about their science topics as well as those of their classmates, and also electronics, microcontrollers, programming, public speaking and the practical shop skills needed to turn an exhibit design into reality. Exhibits developed over the last two years have spanned topics in physics, engineering, biology, ecology, geoscience, and astronomy. I will discuss the benefits of such school-museum partnerships, as well as difficulties encountered.

11:30-11:45

TPT in NC

Karl C. Mamola (Appalachian State University), *The Physics Teacher*, Dept. of Physics and Astronomy, Appalachian State Univ., Boone, NC 28608, (828) 262-7497 (Office), (828) 262-7329 (FAX), TPT@APPSTATE.edu

North Carolina teachers play a large role in helping to maintain the high quality of *The Physics Teacher*. Many members of NCS-AAPT write for TPT and serve as manuscript referees. In this talk I will give some general information about the journal, discuss the kinds of articles we publish, and describe our process for selecting the papers that eventually appear in our pages. Some outstanding recent articles by NC teachers will be highlighted, and potential authors will be encouraged to submit their new and interesting physics teaching ideas to our editorial office.

11:45-12:00

Reflection Phase Shifts from Dielectric Surfaces

C. Bennett (UNC Asheville), Dept of Physics, UNC Asheville, Asheville, NC 28804, (828) 251-6047, (828) 251-6397 fax, bennett@unca.edu

Reflection and transmission phase changes for normal incidence are given in introductory physics textbooks as follows: 180 degrees for external incidence reflection, zero for internal incidence reflection and zero for transmission. At the upper-level, however, treatments are inconsistent. Many texts derive opposite phase shifts at normal incidence for equivalent polarization states, and nearly all assign a phase transition at Brewster's angle. The inconsistency can be eliminated by interpreting a negative value of the Fresnel ratios as an indication that the starting diagram was wrong, instead of an indication of a phase shift. This approach gives results that are unambiguous and independent of the starting diagram: a phase shift of 180 degrees for external incidence reflection at all angles of incidence, no phase shift for internal incidence reflection at all incident angles less than the critical angle, and no phase shift for transmission.

12:00-12:15

The Current Role of a Current Textbook

A. Titus (High Point University), Department of Chemistry and Physics, High Point University, 833 Montlieu Ave, High Point, NC 27262, 336-841-4668, 336-888-6341 (fax), atitus@highpoint.edu

As generations evolve, so do their culture, habits, tools, and values. This is quite apparent in the physics classroom. While the textbook has largely remained the same in content and format (with a few notable exceptions), how students use a textbook has likely evolved. Today's students are perhaps more likely to use electronic resources such as Wikipedia than their textbooks. Furthermore, they are perhaps more likely to search for a certain topic than read a book or chapter from beginning to end. In this talk, a wiki will be demonstrated as a possible alternative to a textbook. With LaTeX (for generation of equations), search capabilities, automatic generation of a table of contents, embedded simulations with iframes, and multi-person editing, it seems to have potential as an ebook that students will use and teachers can customize. Sample wiki pages with embedded Physlets and example problems will be demonstrated.

12:15-12:30 **Arguments Casting Doubt on the Role of Humans in Global Warming**

J. Hubisz (North Carolina State University), North Carolina State University, 1604 South Salem Street, Apex, NC 27502-7251, (919)362-5782 (Voice & FAX), Hubisz@unity.ncsu.edu

As the question of “Global Warming” is presented and reported, it appears that there is no question, “Humans are responsible for global warming and we have to do something about it immediately.” I suggest that we have to slow down and ask a few questions first.

12:30-1:30 Lunch Vail Commons

1:30-2:00 Business Meeting Dana 146

2:00 Workshop Dana 111

Rocketry by Doug Knight

The Team America Rocketry Challenge

Background and rules for the Team America Rocketry Challenge will be discussed.

We will describe hobby rocketry and how it applies to the competition and highlight details on how to organize and manage a competing team along with providing practical advice.

3:00 Break Dana 126

3:00 Workshop Dana 127

ComPADRE led by Susana Deustua

Thanks to a special grant from Davidson College's Dean of the Faculty, registration for all high school teachers at this meeting will be \$8.00. This reduced fee includes registration, lunch on Saturday and workshop registration.

Election

Elections will be held at the Spring meeting. We are accepting nominations and will hold elections for Secretary-Treasurer, High School Representative, and Vice-President.

Prizes and Awards

As is usually the case at our meetings, prizes will be awarded for the best undergraduate (\$100), graduate (\$100) and pedagogical (\$150 toward travel expenses to present a similar paper at a national meeting) papers. The best undergraduate award will be given to the best paper or poster presentation at the joint NCS-AAPT/SPS Meeting.

Your mailing label

If your mailing label has LIFE, "2008" or greater, your dues are paid up. Otherwise please send \$5.00 along with your registration for each missing year.

E-mail addresses

If you did not receive an e-mail message about this meeting and you have access to e-mail, please send a note to John Hubisz at hubisz@unity.ncsu.edu with your correct e-mail address.

Future Meetings

Fall 2008: Tentatively NCSU or with SESAPS (October 30-Nov 1)

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