The 'Discovery of Electron' & the Nature of Science_

Conference Paper · January 1998

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Nahum Kipnis
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Winter Meeting

AAPT's 1998 Winter Meeting

HYATT Regency New Orleans, LA

January 3-8, 1998

Edwin Taylor
wins Oersted Medal

Douglas Osheroff
wins Richtmyer Award

1998 APS/AAPT Joint Meeting Information

Session: GE

Contributed Session on History and Philosophy of Physics

Date: Thursday, Jan. 8

Time: 10:15 a.m.- 11:45 a.m.

Room: Burgundy C/D

Presider: John Fitzgibbons, Syracuse Univ., 201 Physics Bldg., Syracuse, NY 13244; 315-443-5999; jdfitzgi@suhep.phy.syr.edu

GE1 10:15 a.m. Cosmological Thought: A 'Science in Context' Course

Matthew Moelter, Univ. of Puget Sound, Dept. of Physics, Tacoma, WA 98416; 253-756-1373; moelter@ups.edu

We describe an interdisciplinary, team-taught course that follows a chronological approach to the study of Cosmological Thought from c.1500 BC to the present. This course is part of our new 'Science in Context' graduation requirement for all students. In each of three historical periods (Ancient and Medieval, Scientific Revolution, and Modern) we identify and discuss the dominant mature cosmology: Aristotle/Ptolemy, Newton/Copernicus, Einstein/Big Bang. The fundamental physical ideas are presented, paying close attention to the nature and extent of space and time. Throughout the course, we consider the social, historical, and philosophical ideas which influence cosmological thought. Pedagogical and logistical issues will also be discussed.

GE2 10:30 a.m. APS Minority Physicist Archive

Cynthia Keppel, Hampton Univ. / Jefferson Lab, Physics Dept., Hampton, VA 23668; 757-727-5823; keppel@jlab.org

The American Physical Society Committee on Minorities has recently commissioned the Hampton University Physics Department and Society of Physics Students (SPS) to create a minority physicist archive. Archive information, in the form of biographies, will be available on a World Wide Web homepage maintained and updated by the Hampton SPS chapter. The status of this archive will be presented as well as plans for the future. It is hoped that the audience will make suggestions for making the archive a useful and informative educational tool for students of all ages and backgrounds.

GE3 10:45 a.m. Faith or Understanding?

Lewis C. Epstein, 614 Vermont St., San Francisco, CA 94107; 415-826-3488

Was there ever a time (like now) when physicists understood less about the central ideas of physics? The conundrum: basic questions most physics and astronomy professors can't answer. A proposed solution.

GE4 11:00 a.m. Constructing Newtonian Mechanics by Investigating Whole-System Inertia

Melvin S. Steinberg, Smith College, Dept. of Physics, Northampton, MA 01063; 413-585-3804

Newtonian mechanics may be constructed using tactile and visual information from simple experiments on whole-system inertia, including additivity and invariance of mass values, which link the First and Third Laws at a low level of abstraction. The experiments are inspired by two interrelated aspects of Newton's own learning path. (1) His early study of collisions identified a concrete center-of-mass concept as key to intuitive understanding of the dynamical Third Law. (2) His pre-*Principia* struggle to conceptualize whole-system inertia identified mass as an idea that needed further elaboration. Rethinking mechanics instruction with these issues in mind may help students modify their preconceptions about uncaused motion and reciprocal forces.

GE5 11:15 a.m. Physics and Human Thought, Reflections on a New Course

Michael Goggin, Univ. of Southern Indiana, 8600 Univ. Blvd., Evansville, IN 47712; 812-464-1713; mahler@deepcnet.usi.edu

A new course was implemented at USI in the Fall 1997 semester. This course is neither a "traditional physics course" nor a "traditional humanities course." Is is a hybrid of the two. The course covers some of the important ideas in physics, particularly special relativity and quantum mechanics, and their relationship to other areas of human thought, e.g., philosophy, literature, and art. The emphasis of the course is on learning the physics and the significance of the ideas presented. Physical theories are framed in the context of the times in which they developed. The worldview of the physicist that results from these new ideas is explored, with discussion of how this worldview compares and contrasts to the worldview of other fields. Connections to other areas are made through readings, excerpted in the text, as well as from outside sources. These readings are from works that have a direct connection to physics. The course involves both the solving of "traditional physics problems" and the writing of essays relating the ideas developed in the problems to a wider context. A detailed description of the course will be presented along with a post-course analysis.

GE6 11:30 a.m. The "Discovery of Electron" and the Nature of Science

Nahum Kipnis, Bakken Museum, 3537 Zenth Ave. S., Minneapolis, MN 55416; 612-927-6508; nahum.kipnis-1@umn.edu

A few examples of historical discoveries can increase students' interest in physics. The discovery of the electron, for instance, sheds a new light on the relations between theory and experiment and the role of precision. According to the tradition, it was an experimental discovery made by J.J. Thomson in 1897 as a result of measuring the charge-to-mass ratio e/m for cathode rays. He found that these particles were about 1,000 times lighter than hydrogen atoms and supposed them to be components of all atoms. Actually, that was only a part of a long and complex story. The particular nature of electricity in electrolytes was well accepted before 1895, and theoreticians attempted to extend it to other media. The first idea of a small particle came from the Zeeman effect (1896), Becquerel extended it to radioactivity, and Lenard to photoelectricity. On the basis of very crude measurements these results were generalized in 1900 into the concept of a universal charged particle called "electron."

Session: GF

Postdeadline

Sponsor:

Date: Thursday, Jan. 8

Time: 9:00 a.m.

Room: Royale

Presider: Laney Mills, Dept. of Physics and Astronomy, College of Charleston, Charleston, SC 29424; 803-953-8072; millsl@ashley.cofc.edu

(See Addendum, which will be distributed onsite, for abstracts and times)