NJAAPT

New Jersey
American Association
of Physics Teachers

SPRING 2011
SECTION
MEETING

March 18-19, 2011
Princeton University

Welcome to the New Jersey AAPT Spring Section Meeting!

The title and focus of the 2011 section meeting is. "From The Infinitely Small To The Incredibly Large", with topics ranging from particle physics to cosmology.

Special thanks to Geoffrey Gittelfinger and Ed Groth from Princeton University for their help and the use of Princeton facilities. Thanks also to the Executive Board for all of their planning efforts, to Jessie Blair for coordinating the meeting and catering arrangements.

We especially thank our guest speakers, who have taken time out of their busy schedules to be here.

We hope that you will find the meeting informative and enjoyable, and we look forward to seeing you at future events.

AAPT
PHYSICS EDUCATION

NJAAPT
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SCHEDULE of EVENTS

Friday March 18, 2011
Jadwin Hall

5:30 – 6:30 p.m.	Registration, Wine and Cheese Reception
6:30 – 7:30 p.m.	Dinner -- Buffet style in the Joseph Henry Room
7:45 – 9:00 p.m.	Guest Speaker: **Richard Gott** Princeton University *"Measuring the Size of the Universe"*

SCHEDULE of EVENTS

Saturday March 19, 2011
McDonnell Hall

8:00 – 9:00 a.m.	Registration, Coffee, Tea, Bagels
9:00 – 9:15 a.m.	Introduction and Welcome: **Ray Polomski** President of NJAAPT
9:15 – 10:15 a.m.	**Eva Andrei** Rutgers University *"Graphene"*
10:15 – 10:30 a.m.	Break
10:30 -11:30 a.m.	**Steve Schnetzer** Rutgers University *" What's New at the LHC? "*

11:30-12:45 p.m.	Lunch (included)
12:45 – 1:15	Section Meeting
1:15 – 2:30 p.m.	**H. Cynthia Chiang,** Princeton University *"Observing the Origins of the Cosmos"*
2:30 – 4:00 p.m.	**Ed Groth**, Princeton University *"Death Demos: In Which The Students Think The Lecturer Might Get Maimed Or Die!"*

Richard Gott

Princeton University
Dept. of Astrophysical Sciences

" Sizing Up the Universe "

J. Richard Gott is noted for his contributions to cosmology and general relativity. He has received the Robert J. Trumpler Award, an Alfred P. Sloan Fellowship, the Astronomical League Award, and Princeton's President's Award for Distinguished Teaching. He was for many years Chair of the Judges for the Westinghouse and Intel Science Talent Search. His paper "On the Infall of Matter into Clusters of Galaxies and Some Effects on Their Evolution" co-authored with Jim Gunn has received over 1500 citations. He proposed that the clustering pattern of galaxies in the universe should be spongelike--a prediction now confirmed by numerous surveys. He discovered exact solutions to

Einstein's field equations for the gravitational field around one cosmic string (in 1985) and two moving cosmic strings (in 1991). This second solution has been of particular interest because, if the strings move fast enough, at nearly the speed of light, time travel to the past can occur. His paper with Li-Xin Li, “Can the Universe Create Itself?” explores the idea of how the laws of physics may permit the universe to be its own mother. His book Time Travel in Einstein's Universe was selected by Booklist as one of four “Editors’ Choice” science books for 2001. He has published papers on map projections in Cartographica. He wrote an article on time travel for Time magazine as part of its cover story on the future (April 10, 2000). His and Mario Juric’s Map of the Universe appeared in the New York Times (January 13, 2004), New Scientist, and Astronomy. Gott and Juric are in Guinness World Records 2006 for finding the largest structure in the universe: the Sloan Great Wall of Galaxies (1.37 billion light years long). Gott’s Copernican argument for space colonization was the subject of an article in the New York Times (July 17, 2007).

Sizing Up the Universe

In my new book, “Sizing Up the Universe” with Bob Vanderbei, we have a series of scaled pictures each at 1000x smaller scale than the one before, starting with Buzz Aldrin’s footprint on the moon, and ending with the entire visible universe in one picture. This is the first time such a picture of the entire visible universe could be made using real data; it includes 126,594 galaxies and quasars from the Sloan Sky Survey and, around the perimeter of the map, the WMAP data on the cosmc microwave background. The centerpiece of the book is the logarithmic MAP OF THE UNIVERSE, 40 inches long, that includes in a conformal (shape-preserving) projection, everything from satellites in Earth orbit, to the Moon, planets, nearby stars, and distant galaxies all the way out to the cosmic microwave background, all on one map.

Eva Andrei

Rutgers University
Dept. of Physics and Astronomy

"Graphene"

Eva Y. Andrei received her BS and MS degrees from Tel Aviv University, and in 1981 received a Ph.D. in Physics from Rutgers University investigating vorticity and sound propagation in rotating superfluid helium. She then joined Bell Laboratories, where she studied two dimensional electron layers on helium films. Dr. Andrei joined the faculty in the Rutgers Department of Physics and Astronomy in 1986, where she is currently a Professor.

Professor Andrei is a Fellow of the American Physical Society (APS), a fellow of the American Association for the Advancement of Science (AAAS), and has served on the executive board of the APS. Dr. Andrei was awarded the French CCEA Medal of Physics for her work on the Magnetically-Induced Wigner Crystal, and the Rutgers Board of Trustees Award for Excellence in Research for her work on graphene.

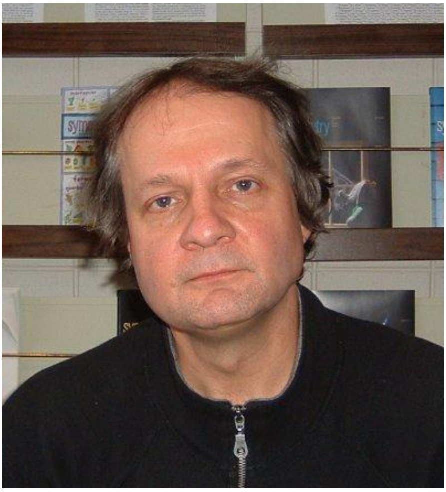
Graphene – an ideal material

Graphene is a two-dimensional form of crystalline carbon whose laboratory realization - for which Andre Geim and Konstantin Novoselov shared the 2010 Nobel Prize in physics – has opened new vistas of fundamental physics and applications making it one of the most active research frontiers in the physical sciences. The initial interest in graphene was driven by its fascinating electronic properties: electrons moving in a landscape of carbon atoms arranged in a honeycomb lattice lose all their mass and behave like relativistic Dirac particles rather than as massive non-relativistic electrons that inhabit usual semiconductors and metals. This is an example of emergence, where the collective behavior of a complex system is entirely different from its constituents. Graphene is made of carbon atoms but the collective behavior is described by relativistic quantum theory. Thus one can imagine testing fundamental principles, some of which are beyond the reach of giant accelerators, in a tabletop experiment. More recently it was realized that graphene's many other extraordinary physical characteristics - atomic thickness, record breaking strength, impermeability and chemical sensitivity - make it a nearly ideal material for many potential applications. I will review the physical properties of graphene and present experimental results which provided access to the unusual charge carriers in this material.

Steve Schnetzer

Rutgers University
Dept. of Physics and Astronomy

" What's New at the LCH?"



Steve Schnetzer is the senior member of the Rutgers High Energy Physics group and has been active in research in fundamental particle physics for over three decades. Steve earned his Ph.D. from Rutgers University. In the 1980's, he was co-founder of an international collaboration that constructed a large collider experiment for the TRISTAN electron-positron collider in Japan. In the 1990's, he worked on a major experiment at Fermilab studying matter-antimatter asymmetry. Twenty years ago, he proposed and pioneered the use of synthetic diamond as a radiation-hard particle detector. He currently works on the Compact Muon Solenoid experiment, one of the large detector facilities being built for the Large Hadron Collider (LHC) at CERN.

The Physics of the Very Small: Results from the Large Hadron Collider

Experiments at the Large Hadron Collider (LHC) at CERN probe the structure of nature down to an unprecedented tiny distance scale, a billion times smaller than atomic size. I will discuss the limitations of our current understanding of fundamental physics at these small distances and describe some of the current ideas of "new physics" (Higgs, supersymmetry, extra dimensions, strong gravity) that we might be seen, as a result, at the LHC. I'll conclude by presenting some of the results from the first year of LHC running and discuss what exciting discoveries might be expected by the end of this year.

Beth A. Cunningham

Executive Office

American Association of Physics Teachers

Beth Cunningham joined the AAPT as Executive Office in January, 2011. She has a B.S, M.A., and Ph.D. from Kent State University. She was a post-doctoral fellow at the Hormel Institute at the University of Minnesota, and taught Physics at Gettysburg College. From 1989-2002 at Bucknell University, she progressed the faculty ranks to full professor. Her administrative responsibilities at Bucknell included design and supervision of faculty development in the areas of teaching, scholarship, and professional development. She also developed and administered the Bucknell Physics Department Summer Undergraduate Research Program. In 2006, she was appointed provost, dean of faculty, and professor of physics at Illinois Wesleyan University. There, she initiated a strategic curricular review to enhance academic programs and external reviews of academic departments.

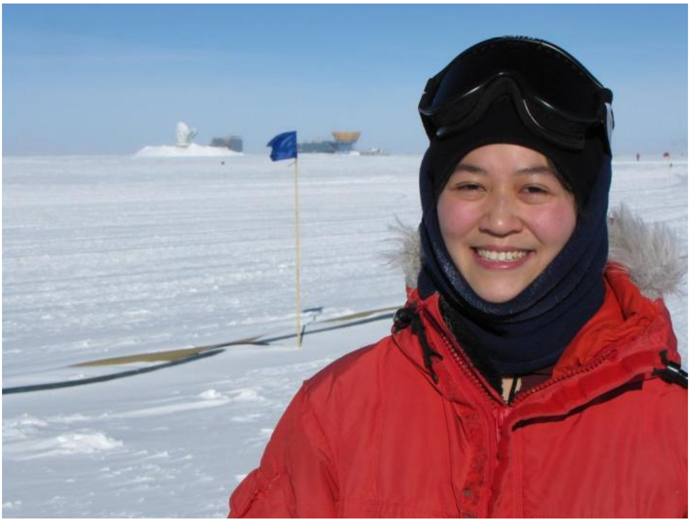
At AAPT, Beth is providing leadership on a number of physics education initiatives including the collaboration with the American Physical Society on the PhysTEC project, a major initiative to increase the number and quality of high school physics teachers, the development of an e-Mentoring program for new high school physics teachers, the PTRA program, and a new program on “Mobilizing Disciplinary Societies on Behalf of Our Students… and Our Planet” with Project Kaleidoscope.

Beth has been active in educational and professional organizations at the national level such as chairing the Committee on Education in the American Physical Society in 2004. She was co-principal investigator on a National Science Foundation grant recently awarded to Project Kaleidoscope to prepare faculty leaders in science, technology, engineering, and mathematics. She continues to serve as a Counsilor in the Physics and Astronomy Division of the Counsil on Undergraduate Research.

H. Cynthia Chiang

Princeton University

" Observing the Origins of the Cosmos"



H. Cynthia Chiang is a postdoctoral researcher in the physics department at Princeton University, where she works with Professor William Jones's group on building telescopes and analyzing data for observational cosmology. She received her Ph.D. from the California Institute of Technology in 2008 and B.S. from the University of Illinois at Urbana-Champaign in 2002. She has a lifelong addiction to tinkering and puzzles, and she's delighted that her job allows her to pursue both of these every day.

Observing the Origins of the Cosmos: What We Know About the Structure and Evolution of the Universe.

Abstract

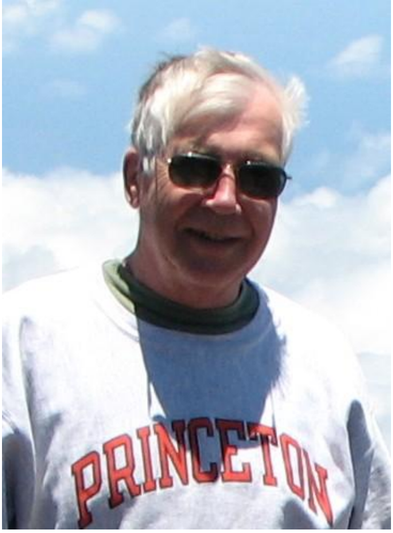
Cosmology, the study of the origins and evolution of the universe, is an active area of research that has made rapid progress with the recent flood of observational data and development of precision instrumentation.

One of the most valuable tools for studying the universe is the cosmic microwave background (CMB), which is the “afterglow” of the Big Bang and is thus a direct snapshot of the universe in its infancy. The CMB contains a wealth of information, encoding the universe’s history from moments after the Big Bang up to the era of structure formation. I will describe our current knowledge of the CMB, what it has taught us about the universe, and the telescopes that are currently under construction to measure the CMB with even finer precision.

Ed Groth

Princeton University

" Death Demos:
In Which The Students Think The Lecturer Might Get Maimed Or Die!""



Professor Edward Groth received a BS from Caltech in 1968 and a PhD from Princeton University in 1971, both in Physics. He has been a member of the Princeton Physics Faculty since receiving his PhD. He has taught almost all the courses in the undergraduate physics curriculum as well as graduate physics courses and freshman seminars. His research has included IR astronomy, high-speed optical photometry including timing of the Crab Pulsar, and studies of large scale structure and cosmology. In 1977 he was selected as the Data and Operations Team Leader for what became the Hubble Space Telescope. After launch in 1990, he was appointed the Deputy Principal Investigator for the Wide Field and Planetary Camera Instrument. He also served on the ad-hoc committee to characterize the error in the primary mirror; a prerequisite for the fixes put in place at the time of the first servicing mission in late 1993. His research included carrying out the first HST survey, now known as the "Groth Strip," and the first weak lensing analysis of HST data. He also participated in Keck observations to obtain spectroscopy for the objects in the survey. He has participated in an Optical SETI project and has served (2004-2009) on the External Independent Readiness Board for NASA's Navigator program which seeks to discover and characterize Earth-like planets orbiting in the habitable zones of nearby stars. Professor Groth served on the 1980 Astronomy Decadal Review committee. He was the Associate Chair of the Princeton Physics Department from 2001-2008. He has served as Princeton's representative to USRA for a number of years and as Vice-Chair of the USRA Council of Institutions, 2006-2008, and Chair of the Council and member of the Board of Trustees, 2008-2010.

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