

**AMERICAN PHYSICAL SOCIETY**  
*New England Section Newsletter*

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Paul H. Carr & Laurence I. Gould, Co-Editors

**Fall 2009 Joint Meeting of the New England Sections of the APS and AAPT**



**Our Universe – 400 Years After Galileo**

**Friday and Saturday – October 16-17, 2009**

**University of New Hampshire**

**Durham, NH**

Registration, Abstract, and Housing information can be found at the  
conference web site:

<http://astrophysics.sr.unh.edu/nesaps/>

## INVITED SPEAKERS

### **Professor Galileo's 21st Century Syllabus**

Prof. Timothy Slater (University of Wyoming)

Precisely four hundred years ago, Italian scientist Galileo's observations of the heavens forever and profoundly altered the way we view our place in the Universe. Among many influential observations he made with the newly invented telescope, he observed that our Moon's surface is not smooth, but covered with countless impact craters. He was the first to measure our Sun's rotation by monitoring sunspots. He demonstrated that the planets orbit our Sun by observing that the planet Venus shows Moon-like phases. He recorded four moons orbiting the planet Jupiter, once and for all disproving the widespread notion that Earth was the center of all celestial motions. And he dramatically increased our thinking about the size of the known Universe, discovering that there are thousands of more stars than had ever been thought to exist before. Taken together, Galileo and his telescope initiated one of the most important scientific revolutions in history. But what would he choose to teach if he were alive today?

### **Galileo's Ideas Might Have Been Better Received If He Understood Cognitive Science**

Dr. Stephanie Slater (University of Wyoming)

Over the years, considerable rhetoric exists regarding which instructional strategies induce the largest conceptual and attitude gains in helping K-12, college students, and the general public learn science. In response, the Cognition in Astronomy, Physics and Earth Sciences Research (CAPER) Team at the University of Wyoming is conducting a systematic study of how people learn science through astronomy. By uncovering cognitive processes, including misapplied phenomenological primitives and spatial reasoning strategies, the CAPER Team is developing and testing a series of innovative classroom instructional materials constructed upon a highly scaffolded approach, grounded in inquiry-instruction, that has applications across many scientific disciplines.

Professors Tim and Stephanie Slater run the inter-college Cognition in Astronomy, Physics and Earth Sciences Research (CAPER) Team at the University of Wyoming. Tim is the University of Wyoming Excellence in Higher Education Endowed Chair in Science Education and the Education Officer for the American Astronomical Society. Stephanie is the University of Wyoming Outreach Professor for the Science and Mathematics Teaching Center. They have a national reputation as innovators in applying astronomy education research to learning environments and serve on numerous high profile committees and boards, are widely published, and popular speakers on science education and teacher education at national conferences. Information on their unique MS & Ph.D. programs can be found at: <http://www.uwyo.edu/caper>

### **Fermi Gamma-ray Space Telescope: First Year Highlights**

Dr. David J. Thompson (NASA Goddard Space Flight Center)

The Fermi Gamma-ray Space Telescope, formerly called GLAST, recently completed its first year of surveying the high-energy sky. Some key observations include: (1) Gamma-rays from pulsars appear to come from a region well above the surface of the neutron star; (2) Multiwavelength studies of blazars show that simple models of jet emission are not always adequate to explain what is seen; (3) Gamma-ray bursts can exhibit strong emission at high energies even from distant bursts; (4) Cosmic-ray electrons at energies approaching 1 TeV seem to suggest a local source for some of these particles.

Dr. Thompson is Deputy Project Scientist for the Fermi Gamma-Ray Space Telescope Mission. His research spans all areas of astrophysics related to high-energy gamma rays. Prior to his work on the Fermi mission, Thompson was involved with the Compton Gamma Ray Observatory, the second of NASA's Great Observatories, which operated in orbit from 1991-2000.

**After 400 years, some of us still get it wrong: Science Errors on TV (A Personal Experience)**  
Prof. Neil F. Comins (University of Maine)

We all know that students come to our classes with misconceptions (deep-seated incorrect beliefs) about our astronomical environment. While some of these beliefs have their origins in faulty reasoning, many others come from external sources, such as from scientists harboring and sharing the same misconceptions, and from media sources. Neil will share a horror story of how scientists on a TV show about the Moon in which he appeared presented incorrect information and how the producers also manipulated the science presented by the narrator to provide incorrect information that viewers are likely to incorporate into their own belief system.

Prof. Comins and his students do research in a variety of fields, including general relativity, optical and radio observational astronomy, computer simulations of galaxies, and astronomy education. His work in GR was cited in Chandrasekhar's Nobel Prize lecture. He is the author of 14 text and trade books (the latest one, "What if the Earth Had Two Moons?" will be out next January). One his greatest non-scientific achievements is becoming a cartoon character in Japan.

**NASA's Kepler Mission (exact title TBD)**

Dr. Andrea Dupree, Harvard Smithsonian Center for Astrophysics

The Kepler Mission, launched in March of this year, is specifically designed to survey our region of the Milky Way galaxy to discover hundreds of Earth-size and smaller planets in or near the habitable zone and determine how many of the billions of stars in our galaxy have such planets. Results from this mission will allow us to place our solar system within the continuum of planetary systems in the Galaxy.

Dupree is a Past-President of the American Astronomical Society. She has served on and led many committees of the US National Academy of Sciences, NASA, and others to determine the future course of astronomical research in the United States and other countries. She held the position of Associate Director of the Harvard-Smithsonian Center for Astrophysics - the first woman and youngest person in that position and served as Head of the Solar, Stellar and Planetary Sciences Division.

**Imaging the Interstellar Wind and the Boundary of the Heliosphere  
in the "Light" of Neutral Atoms using the Interstellar Boundary Explorer (IBEX)**

Prof. Eberhard Möbius (University of New Hampshire)

On October 19, 2008, the Interstellar Boundary Explorer (IBEX) has been launched, which carries two highly sensitive Energetic Neutral Atom (ENA) cameras that are taking the first global images of the heliosphere's interaction with the surrounding interstellar medium, hence opening another window for astrophysics. Because the Sun moves relative to the local interstellar cloud at  $\approx 26$  km/s, an interstellar wind of neutral gas blows through our solar system, thus forming a point source on the ENA image. In spite of the large size of the heliosphere we can study this flow for H, He, and O directly near Earth. At a distance of about 100 AU the solar wind slows down to subsonic speed through interaction with the interstellar gas, thus forming the termination shock. Here ions are accelerated efficiently. Through charge exchange with interstellar gas atoms these ions are a diffuse source of ENAs. The neutrals – if released towards the Earth – arrive on straight trajectories, carrying information about the energy spectra and spatial distribution of the ion populations in the boundary regions. From the interstellar flow through the inner heliosphere and the image of the boundary ENAs, we glean complementary insight into the exciting observations that the two Voyagers have returned from their recent passage through "termination shock" (a distinct asymmetry of the heliosphere) and the fact that, contrary to theoretical predictions, the source of anomalous cosmic rays has not yet been found at the termination shock. IBEX is fully operational and has taken its first full-sky image. As a bonus, IBEX has also detected neutral atoms from the Moon that have allowed us to determine the Moon's albedo for solar wind impinging on its surface. [Professor Möbius, currently serving as chairman of the UNH Physics Department, is also a member of the IBEX team.]

Spring 2009 Joint Meeting of the APS and AAPT New England Sections

## ELEMENTARY PARTICLE PHYSICS IN THE 21<sup>st</sup> CENTURY

May 8 and 9, 2009

Northeastern University, *Boston, Massachusetts*



The banquet and poster session were held at the Curry student center.



Physics Department Chair Sri Sridhar welcomes us and describes the Northeastern's unique work-study program.

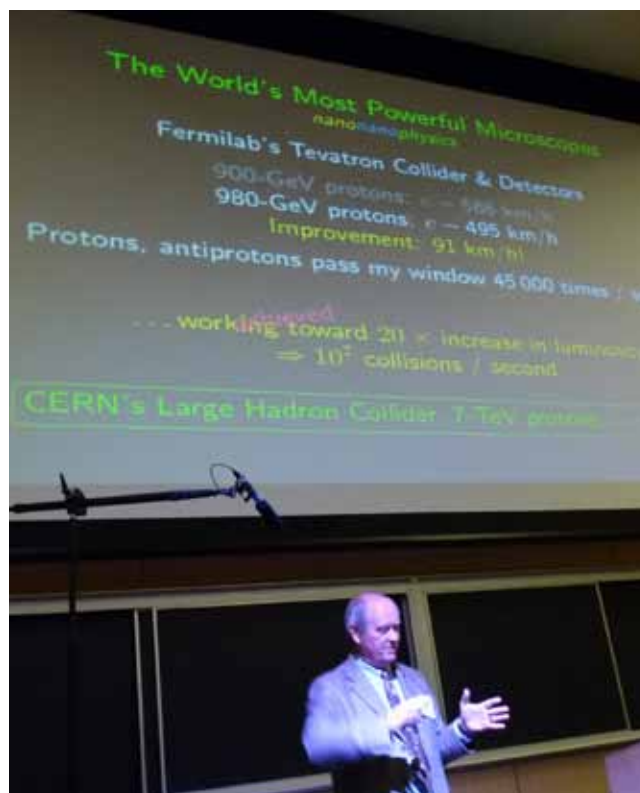
More information can be found at: <http://neu.edu/nesaps/>

**Plenary Speakers** — All plenary talks will be aimed at a general physics audience.

- Physics Education:
  - **Philip Sadler (Harvard-Smithsonian CfA)** *What Predicts Success in Learning Physics?*
- Experiment:
  - **Francis Halzen (University of Wisconsin)** *Icefishing for Neutrinos*
  - **Young-Kee Kim (Fermilab and University of Chicago)** *Fermilab and the Quantum Universe*
  - **Paris Sphicas (CERN and University of Athens)** *Probing the physics of the TeV scale: the CMS experiment at the LHC*
  - **Michael Tuts (Columbia University)** *Elementary Particle Physics at the Terascale: Experiments at the Large Hadron Collider*
- Theory:
  - **Cumrun Vafa (Harvard University)** *Stringy Predictions for Particle Physics*
  - **Chris Quigg (Fermilab)** *The Coming Revolutions in Particle Physics*
- **Special session: Einstein's Waves: where is the graviton?** — focused on the searches for gravitational waves.



Leon Lederman, Nobel Prize in Physics 1988, Illinois Institute of Technology, presents Education to Know the World with all Its Splendor. He advocates "Physics First." Physics should be taught to 9<sup>th</sup> graders before chemistry and biology, because physics is more basic. About 2000 high schools have adopted some version of this program.



## EDITORIALS

Please Note: These content of what follows expresses each writer's considered opinion and should not be construed as representing any official position of any organization, including the Executive Board of the New England Section of the American Physical Society.

The issue of anthropogenic global warming (AGW) is not settled. This can be seen from the Letter below as well as contributions to the debate existing in recent publications of this Newsletter (Fall 2007, Spring 2008, Fall 2008, and Spring 2009 issues can be obtained from the NES APS website [www.aps.org/units/nes/newsletters/](http://www.aps.org/units/nes/newsletters/)).

Given the importance of the topic, we welcome letters (positive or negative) about the issues.

Paul Carr and Larry Gould, Co-Editors  
NES APS Newsletter

### **Email LETTER to the Editors by Patrick Frank**

(received 25 October 2008) —

Item referenced: Email Letter to the Editors by Professor Frank S. Levin (Fall 2008 issue of the New England Section Newsletter [www.aps.org/units/nes/newsletters/fall08.cfm](http://www.aps.org/units/nes/newsletters/fall08.cfm). Earlier issues can be accessed at [www.aps.org/units/nes/newsletters/](http://www.aps.org/units/nes/newsletters/).)

Editors:

I still find myself impressed when a trained physicist engages a scientific question with a polemic, as Prof. Levin has done concerning climate warming (APS NES Fall 2008). The real climate-warming question is attribution and is very simple: *'Can the observed climate warming be scientifically attributed to anthropogenic CO<sub>2</sub>?'* A validly physics-based answer makes superfluous all polemical arguments. One would have expected a trained physicist to approach a scientific question with that clarity, but Prof. Levin did not.

One must look deep within Working Group 1 (WG1) Chapter 9 of the IPCC's Fourth Assessment Report (4AR) to find candid descriptions of attribution studies, and in the Chapter 9 Supplement Appendix 9.B: "**Methods Used to Estimate Climate Sensitivity and Aerosol Forcing,**" one reads:

*"[D]iscrepancy between observed and simulated temperatures [can be] due to, for example, observational uncertainty, forcing uncertainty or internal climate variability. These uncertainties affect the width of the likelihood function, and thus the width of the posterior distribution. ... The prior distribution  $p(q)$  that is used in this calculation is chosen to reflect prior knowledge and uncertainty (either subjective or objective) about plausible parameter values, and in fact, is often simply a wide uniform distribution[, indicating] that little is known, a priori, about the parameters of interest... Even so, the choice of prior bounds can be subjective. ... Alternatively, expert opinion can also be used to construct priors (Forest et al., 2002; 2006). Note, however, that expert opinion may be overconfident (Risbey and Kandlikar, 2002) and if this is the case, the posterior distribution may be too narrow."*

The consensus view is thus that prior bounds on critical parameters within climate models are poorly constrained, subjective, and likely to reflect over-confidence. WG1 Chapter 8 Supplemental Figures S8.5 and S8.14, among other figures, show model errors far greater than the  $\sim 2.7 \text{ W/m}^2$  GHG forcing the same models are purported to detect.

These levels of uncertainty do not allow any reliable assignment of attribution. The large disparity between the actual state of the science and the confidence expressed in the recent IPCC Summary for Policymakers should give any physical scientist skeptical pause.

The “Hockey-stick” proxy temperature constructions were discussed in prior replies, but it should be further noted that there are no known biomarkers or physical metrics whatever that allow extraction of a temperature from a tree ring. All judgments of specifically temperature-limited tree-growth are qualitative and subjective. For example, D’Arrigo, et al., 2000:

*“The trees, of Siberian pine and larch (Larix sibirica Lebedour), were sampled at or very near timber-line (exceeding 2200 m elevation) in settings where temperature, rather than drought stress, appears to be the limiting factor to growth. We base this interpretation on the presence of lush ground vegetation, water seepage, correlations with climate, and other considerations (Jacoby et al., 1996).”[1]*

Jacoby, et al., 1996 say:

*“The sampling location is that of a typical tree-line site where temperature should be the factor that limits tree growth. The vegetation is more lush here than at some (drier) high-elevation sites in the U.S. This difference indicates that precipitation should not be a growth limiting factor.”[2]*

This is all too typical. The D’Arrigo, et al., reference to a prior qualitative judgment adds nothing. From these qualitative judgments proxy tree-ring reconstructions are represented to tenths of Celsius.

It is not controversial that principal components are strictly numerical constructs with no distinct physical meaning. Nevertheless, statistically renormalized principal components derived from tree ring series have been assigned the physical meaning of temperature.[3, 4] Statistics is not a substitute for physics. Purely statistical assignments do not confer physical meaning.

Such methodological errors are rife in modern climate science, and the global average surface temperature (GAST) record is a final example fundamental to the entire modern clamor: In paragraph 18 of the most recent and definitive estimation of the GAST,[5] the statistical uncertainty in monthly mean temperatures is assessed incorrectly as sixty sequential measurements of one observable rather than, correctly, as sixty independent observables measured once sequentially. This mistake erroneously and significantly reduces the reported statistical uncertainty in the GAST, and must have repeatedly passed peer review.

In a recent article at arXiv (<http://arxiv.org/abs/0809.3762>) Richard Lindzen documented the character assassinations and other shameful goings-on in climate science, and in his 2008

Erice Conference presentation (<http://www.climateaudit.org/?p=3651>) Steven McIntyre has related the obscurantism, institutional negligence, and outright obstructionism he has repeatedly encountered in auditing proxy climate reconstructions.

It is long past time for physicists to critically intervene for the integrity of their discipline.

Patrick Frank  
Palo Alto, CA 94301

- <sup>1</sup> D'Arrigo, R., et al. (2000) *Trans-Tasman Sea climate variability since 1740 inferred from middle to high latitude tree-ring data* *Climate Dynamics* **16**(603-610)
- <sup>2</sup> Jacoby, G.C., R.D. D'Arrigo, and T. Davaajamts (1996) *Mongolian Tree Rings and 20th-Century Warming* *Science* **273**: 771-773
- <sup>3</sup> Mann, M.E., R.S. Bradley, and M.K. Hughes (1998) *Global-scale temperature patterns and climate forcing over the past six centuries* *Nature* **392**: 779-787
- <sup>4</sup> Ammann, C.M. and E.R. Wahl (2007) *Importance of the geophysical context for statistical evaluation of climate reconstruction procedures* *Climatic Change* **85**(1-2): 71-88
- <sup>5</sup> Brohan, P., et al. (2006) *Uncertainty estimates in regional and global observed temperature changes: A new data set from 1850* *J. Geophys. Res.* **111**: D12106 1-21

**Editorial by Laurence I. Gould**, <http://uhaweb.hartford.edu/LGOULD>

## **“Global Warming/Climate Change”: Further Developments**

It is heartening to learn that the APS Council is willing to reconsider their earlier Climate Statement. Please read the brief Open Letter to the Council of the American Physical Society:

[www.openletter-globalwarming.info/Site/open\\_letter.html](http://www.openletter-globalwarming.info/Site/open_letter.html)

that contains a list of signatories (click on “signatures”); also includes information if the reader wants to add his/her name ([www.openletter-globalwarming.info/Site/Add\\_name.html](http://www.openletter-globalwarming.info/Site/Add_name.html)). One can also read a recent published Letter in *Nature*, “Petitioning for a revised statement on climate change” (click on “Nature\_Letter” or go to —

[www.openletter-globalwarming.info/Site/Nature\\_Letter.html](http://www.openletter-globalwarming.info/Site/Nature_Letter.html))

Additional information about the “skeptics” side of the “global warming/climate change” controversy can be found at: [www.heartland.org/events/NewYork09/proceedings.html](http://www.heartland.org/events/NewYork09/proceedings.html) — the International Conference On Climate Change (2009) — Keynote Speakers include Hon. Václav Klaus, Ph.D. (President, Czech Republic and European Union), Dr. Harrison Schmidt (former NASA astronaut — Moonwalker, Apollo 17), Professor Richard Lindzen (Alfred P. Sloan Professor of Meteorology at MIT). [Videos and PowerPoint presentations may be freely viewed or downloaded.]



Editorial by Paul H. Carr, [www.MirrorOfNature.org](http://www.MirrorOfNature.org)

## **Man on the Moon: 40 Years Ago**

Do you remember that our goal to land a man on the moon was set during the Cold War between Communism in the East and the Western Democracies?

In 1957, the Russians orbited the first satellite, Sputnik. The first attempts of the United States to match this breakthrough exploded on the launch pad. President Kennedy in 1961 announced the national goal of landing a man on the moon within the decade.

On July 20, 1969, Wernher von Braun's rocket technology enabled Neil Armstrong to send the first message from our closest heavenly neighbor: "That's one small step for man, one giant leap for mankind."

In contrast to this scientific and technical milestone in human history, our cities were burning from racial unrest and our superior military technology was not winning the Vietnam War. People asked: "Why did we spend so much money on exploring space when we have so many problems here on earth?"

Science had few answers, but religious leaders like Rev. Dr. Martin Luther King, Jr. had followed Gandhi's example of non-violent resistance to racial discrimination. (King earned his doctorate from the Boston University School of Theology). His "I Have a Dream" speech, together with his assassination, helped convince Congress and President Lyndon B. Johnson to pass comprehensive civil rights legislation. This advanced racial equality.

In the 1980s, President Ronald Reagan's Star Wars vision for a missile space defense system led to a resurgence of government investment in science and technology. This, coupled with his diplomatic initiatives with USSR's Premier Gorbachev, resulted in a peaceful resolution of the 45-year Cold War. Science and technology had indeed contributed.

In 1994, the hope of abolishing South African apartheid was fulfilled. Bishop Tutu's and Nelson Mandela's policy of forgiveness enabled a relatively smooth and bloodless transition to democracy.

Religious leaders like Rev. Dr. Martin Luther King and Bishop Tutu have contributed to the achievement of the hope of resolving human conflicts. Advances in racial equality and the peaceful resolution of the Cold War were achieved through the efforts of scientific, religious, and governmental leaders.

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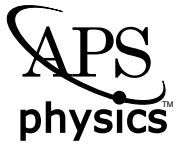
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