

# New England Section Newsletter

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Volume 13

Number 1

Spring 2007

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

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## **The Spring Joint Meeting of the APS and AAPT New England Sections April 20-21, 2007 The University of Maine , Orono , ME**

The annual Spring joint meeting of the NES-APS/AAPT is scheduled for April 20-21, 2007 at the University of Maine , in Orono , Maine . The technical program will focus on Statistical Physics and Applications, with invited speakers from diverse fields such as biophysics and spin glasses. The APS invited speakers represent three different branches of physics that have a common connection through the use of statistical physics. The AAPT invited speakers will discuss research in science education at the high school and college levels. Both APS and AAPT components will include invited sessions and contributed oral and poster sessions, and the AAPT component will also include workshops.

**Banquet Speaker:** Marc Abrahams, Harvard (Editor of Annals of Improbable Research)

### **Invited Speakers ---**

APS:

- Sam Hess, U. Maine
- Daniel Stein, NYU
- one more TBA (inviting Anna Lin, Duke; haven't heard outcome yet)

AAPT:

- Philip Sadler, Harvard
- David Pritchard, MIT

**Abstract Deadline: April 3**

Hotel reservation conference-rate deadline is mid-March for two of the three hotels, and early April for the third

For updated information, go to the U. Maine Physics and Astronomy web page, <http://www.physics.umaine.edu/> and follow the link to the meeting page.

**The Fall Joint Meeting of the APS and AAPT New England Sections  
"The Physics of Sports"  
October 13-14, 2006,  
College of the Holy Cross, Worcester , MA**

The annual Fall joint meeting of the NES-APS/AAPT was held on October 13-14, 2006 on the hill-side campus of the College of the Holy Cross overlooking Worcester , Massachusetts . The technical program focused on the physics of sports and athletics. About 180 people attended including 40 students. Invited speakers addressed a spectrum of topics, from the dynamics and kinematics of baseballs, baseball bats, footballs and football players to that of divers and gymnasts, the variability of sport records, and the effects of technology on sports. It was an excellent program for researchers, teachers and students alike. The AAPT program was comprised of workshops, contributed speakers, and poster sessions, while the APS program included contributed speakers and poster sessions in addition to the plenary sessions. The Conference web site is [www.holycross.edu/departments/physics/website/NES-APS-AAPT](http://www.holycross.edu/departments/physics/website/NES-APS-AAPT)



Matthew Koss, who co-chaired the meeting with De-Ping Yang, welcomed us to the College of the Holy Cross overlooking Worcester , MA .

**Organizing Committee:**

Bob Allison, Bridgewater State  
Matthew Koss, Holy Cross  
Tom Narita, Holy Cross  
Nick Nicastro, Wachusett Regional HS  
Paul Oxley, Holy Cross  
Timothy Roach, Holy Cross  
De-Ping Yang, Holy Cross

**Program**

**Friday, October 13, 2006**

Hogan Campus Center

2:00 PM Welcome by Matthew Koss

2:15 PM Plenary Talk I: **"The Physics of Baseball"**

Robert K. Adair, Yale University

Science illuminates most aspects of baseball. I emphasized here, first, the constraints on the game from limits on biological information transfer. The human response time is about 0.01 seconds. Then I will leave biology for fluid dynamics and discuss our incomplete knowledge of the flight of thrown and batted baseballs through the air.

### 3:30 PM Plenary Talk II: "**Baseball Bat Research and Regulations**"

Patrick Drane, Baseball Research Center , University of Massachusetts Lowell

This talk focused on the equipment regulations in baseball and discussed the physics and engineering relating to the bat-ball collision. I described how and why the equipment is regulated and include aspects of how we test properties of both the bats and baseballs. Topics include aluminum versus wood bats, corked bats, bat durability, stiffness and mass distribution as it relates to baseball bats, and specifications of the major league baseball including the lack of the "juiced baseball."

### 4:30 PM Plenary Talk III: "**Angular Momentum of the Human Body**"

John Di Bartolo, Polytechnic University

Movement of the human body in the sagittal plane (the plane which slices the body between left and right) can be simulated with a simple model made up of four rods and a sphere. In a situation where the torque about the center of mass is zero (such as diving into water) the angular momentum of the body about the center of mass is conserved. In a situation where the torque about the center of mass is non-zero (such as jumping or swinging by one's hands from a bar), the angular momentum of the body about the center of mass has a rate of change equal to the torque. Based on these principles, as the configuration of the model's limbs changes, the orientation of the model changes accordingly. Using this model, a software authoring application called Director (by Adobe) was used to program simulations for Physics Curriculum and Instruction. [http://physicscurriculum.com/physics\\_of\\_sports.htm](http://physicscurriculum.com/physics_of_sports.htm)

The simulations demonstrate the three above-mentioned activities: diving, swinging, and jumping. A user of this software can determine how the "athlete" will move his/her joints over a period of time, and the resulting motion of the body is shown.

5:30 PM Joint APS-AAPT poster session



James Daly (right) of Holy Cross, discusses the poster paper "Apparatus for Laser Excitation of Lithium Atoms." Co-author Suzy Flaherty (on the left) co-authored the paper with Paul Oxley.

6:30 PM Banquet

7:30 PM Post-banquet talk: "**The Physics of Football,**" Timothy Gay, University of Nebraska

This talk discussed a series of one-minute physics lectures given to the 78,000 fans that attend the University of Nebraska home football games. The lecture topics range from gyroscopic motion to ionizing collisions between linebackers and I-backs. The problem of simultaneous edification and amusement of the fan in the stands is considered. Several physics tips for the Crusaders will be proffered. Reference: *The Physics of Football: Discover the Science of Bone-Crunching Hits, Soaring Field Goals, and Awe-Inspiring Passes* , Harper Paperbacks 2005



Post-Banquet Speaker, Timothy Gay, demonstrates the conservation of momentum.

Question: When the lead ball is dropped on (1) the light wooden box and (2) the lead brick shown above, which coffee cups are crushed the most?

Answer: The coffee cups under the wooden box are damaged more than the ones under the lead brick because the velocity imparted to the lead brick is less than that of the light wooden box.

**Saturday, October 14**

Haberlin Hall & Swords Hall

8:00 AM Parallel APS and AAPT contributed talks:

APS contributed talks AAPT contributed talks

10:00 AM Plenary Talk IV: "**Sport Technology Policy: The Balancing Act**"

J. Nadine Gelberg [www.GetCharged.org](http://www.GetCharged.org)

Technological innovation can reduce costs and injuries, increase participation opportunities, but can also usurp the challenge of the sport, allow the wealthy to buy victories, and transform sport from a contest among athletes to a championship of engineers.

How can we protect our games from becoming futuristic robotic competitions? How can sports organizations encourage the technology that allows sports to grow while protecting the core challenge and tradition of our games? How can we set limits when we do not know from where the next revolutionary technology will emerge?

This talk will explore how sports organizations can write proactive performance standards to allow manufacturers maximum flexibility in design and materials while protecting those skills critical to the sport.

#### 11:00 AM Plenary Talk V: **"The Physics (and Mathematics) of Sports Records"**

Beatte Schmittmann , Virginia Tech

How are records set and broken? Are there simple mathematical techniques which would help us approach this question? I will present a simple introduction to the statistics of extreme values. Motivated by an example from sports records, I will discuss the distribution, averages and lifetimes for a simplified model of such "records." Our input data are sequences of independent random numbers all of which are generated from the same probability distribution. A remarkable universality emerges: a number of results, including the lifetime histogram, are universal, that is, independent of the underlying distribution.

12:30 AM APS Executive Committee lunch meeting

1:30 PM Parallel AAPT workshops (free to all registrants):

**"Begin With Special Relativity"** Elisha R. Huggins, Dartmouth College , [www.physics2000.com](http://www.physics2000.com)

For nearly a century we have lived with an introductory physics curriculum that divides physics into classical and modern parts, and teaches only the classical part to the majority of students. The Physics2000 workshop demonstrates how to easily overcome this divide by starting with special relativity in the first week, and fitting in 20th century topics as you go along.

As examples, we discussed introducing magnetism from Coulomb's law and the Lorentz contraction, taught the time-energy form of the uncertainty principle and introduced Fourier Optics using the pulse Fourier Transform capability of MacScope II.

Free Physics2000 CD, MacScope Instruction manual, and printed texts for those who attend the workshop.

#### **"Assessment Alternatives—Ranking Task Exercises in Mechanics"**

Marti Lynes & Sister Mary Catherine Burns

2:30 PM Parallel AAPT workshops (free to all registrants):

#### **"Ranking Task Exercises and Tippers in Physics"**

Marti Lynes & Sister Mary Catherine Burns

# Phenomenal Physics — "A Guided Inquiry Curriculum for Pre-College Education and Conceptual Physics Instruction at the College Level"

J. Russell Harkay

## GREATER BOSTON AREA STATISTICAL MECHANICS MEETING

Brandeis University

October 21, 2006

Approximately 80 people attended the eighth annual Greater Boston Area Statistical Mechanics meeting on Saturday, October 21, 2006 at Brandeis University. The main goal of these meetings is to offer an informal and supportive environment where people from a variety of departments and institutions can meet and exchange ideas. The usual format is four invited talks of 30 minutes each and many contributed talks of about 3 minutes each. Plenty of time is set aside for informal conversations.

The invited speakers for this year's meeting were:

- Olivia White, MIT, "Describing spin glass dynamics: Which length scales grow?"
- Azadeh Samadani, Brandeis University, "Cellular individuality in directional sensing."
- Corey O'Hern, Yale University, "The figure-8 model: A minimal model for kinetic arrest."
- Subir Sachdev, Harvard University, "Quantum criticality beyond the Landau-Ginzburg-Wilson paradigm."

There were 23 contributed talks, somewhat fewer than in recent years. In spite of the short time of the talks, almost of the talks were given using one of the two notebook computers supplied by Brandeis. All of the talks were delivered without any computer problems, and it looks like the physics community has made the transition from viewgraphs to PowerPoint and the like. As in any transition there are unexpected side effects. One interesting effect was that although the talks did not exceed the three minute limit, few of the speakers left time for questions as was done in past years. And some of the speakers tried to say too much even though most said it well.

Institutions represented included Boston College, Boston University, Brandeis University, Bridgewater State College, Brown University, Clark University, Dartmouth College, Harvard University, MIT, Northeastern University, UMass Boston, UMass Amherst, Wellesley College, WPI, and Yale University.

There were approximately 22 faculty members, 15 post-docs, 35 graduate students, 3 undergraduate students, and 5 from industry at the meeting. Departments represented included applied math, chemistry, engineering, and physics.

Of particular interest to New England Section members is that this meeting has been subsidized by the New England Section for the past 8 years at a cost of approximately \$10 per person for bagels, coffee, and lunch. As a result, the organizers of the meeting have not had to collect a registration fee and organizing the meeting has been relatively straightforward. The meeting is open to anyone, including non-members of the APS and NES, but nonmembers are encouraged to join both.

The NES would like to encourage meetings of this type in the New England area and would welcome requests for financial assistance. The main criteria are that the meeting be open to all,

widely announced, and make some effort to involve people who are not necessarily expert in the field. Requests for subsidies for student attendance are particularly welcome.

The organizers of the meeting are Bulbul Chakraborty, Claudio Chamon, Harvey Gould, and Bill Klein. More information about the meeting including information about the contributed talks can be found at <[physics.clarku.edu/gbasml/](http://physics.clarku.edu/gbasml/)>.

**EDITORIAL by Paul H. Carr**  
**COOL COSMOLOGY: "WHISPER" better than "BANG"**

Isn't the metaphor "whispering cosmos" (1) a more accurate and aesthetic description of the very cool microwave background radiation that permeates the entire universe than "big bang?"

In 1949, cosmologist Fred Hoyle coined "big bang" as a term of derision for Belgian priest George Lemaitre's prediction that the universe had originated from the expansion of a "primeval atom" in space-time. Lemaitre had based this on Einstein's equations of general relativity. Hoyle referred to Lemaitre's "primeval atom" sarcastically as "this big bang idea" during a program broadcast on March 28, 1949 on the BBC. Hoyle said this because it contradicted his own steady state theory, which postulated that matter was continually being created as the universe expanded in accordance with Edwin Hubble's measurements.

In 1964 Radio astronomer Penzias and Wilson discovered a cosmic microwave background noise or whisper from every direction of the cosmos. This rustling whisper is evident to us today as we tune between television and radio stations. They did not understand its origin at first. However, through the scientific grapevine they learned that Prof. Dicke at Princeton University had predicted that Lemaitre's hot "primeval atom" should have cooled to 2.7 degrees above absolute zero. This is Hot-to-Cool Cosmology (HCC.)

John Mather and George Smoot were awarded the 2006 Nobel Prize for physics for their measurement of the anisotropy of the cosmic background radiation with the help of the COBE satellite launched by NASA in 1989. Recently the WMAP (Wilkinson Microwave Anisotropy Probe) satellite has given us a more accurate, beautiful image of the temperature variations of this radiation only 0.4 million years after "the beginning." The cooler regions could have seeded the stars and the galaxies. The Hubble Telescope recently showed us galaxies that formed 1 to 2 billion years after this. Their faint light took 12 billion years to reach the earth.

Continuous creation or steady state theory can not explain the microwave background radiation or cosmic whisper, which has cooled from the expansion of a hot "primeval atom." Yet the term "big bang" still persists. "Big bang" makes no physical sense, as there was no matter (or space) to carry the sound that Hoyle's term implies. The "big bang" is a hypothesis. Other hypotheses may be discovered that can predict the observed "whispering cosmos" as well as dark matter and the nature of dark energy.

How can scientists fault conservatives for rejecting the imprecise, big-bang metaphor? I believe the Whispering Cosmos is more accurate, eternal, and beautiful. It is consonant with Astronomer Mario Livio's aesthetic cosmic principle (2). Since scientific theories express the harmonies found in nature, the theories themselves should be aesthetic. The "whispering universe" is cooler cosmology than the big bang.

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This Editorial was inspired by the Cosmology Theme of the the NES-APS meeting at Boston Universty, 31 Mar - 1 April 2006. The editors welcome your comments. Well-articulated responses will be published as Letters to the Editors.

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Greg Huber (At large Exec Comm.)  
Leslie Brown (See Supp. List)  
Candidate Appointed by Judy Franz

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