Source: American Institute of Physics (AIP)

Released: Wed 05-Mar-2008, 10:15 ET
Embargo expired: Mon 10-Mar-2008, 12:00 ET
Printer-friendly Version

1931-2006 AMERICAN INSTITUTE OF PHYSICS 75 Years of Service

Largest Physics Meeting of the Year, in New Orleans

Libraries
Science News

Keywords
PHYSICS APS AIP MARCH NEW ORLEANS ENERGY CLIMATE

Contact Information

Available for logged-in reporters only

Description

The March Meeting of American Physical Society, the largest physics meeting of the year, will take place March 10-14, 2008 in New Orleans, Louisiana. More than 7,000 scientists are expected to be on hand. The principal topic areas will be condensed matter physics, industrial applications, new materials, chemical and biological physics, fluids, polymers, and computation.

###EMBARGOED### Please do not report on the results mentioned in this press release before 12:00 noon eastern time on March 10, 2008.

Newswise — The March Meeting of American Physical Society, the largest physics meeting of the year, will take place March 10-14, 2008 in New Orleans, Louisiana. More than 7,000 scientists are expected to be on hand. The principal topic areas will be condensed matter physics, industrial applications, new materials, chemical and biological physics, fluids, polymers, and computation. A number of sessions will address social issues.

The March meeting is both a great showcase for fundamental physics research and an engine for producing the kind of practical devices and phenomena that characterize our technological society. Much of the circuitry and advanced materials at work inside your computer, cell phone, DVD player, fluorescent fixtures, hospital MRI devices, or grocery store scanners were first discussed at an APS March meeting years ago. A recent example of a new subject taking off is graphene, two-dimensional carbon. Two years ago there were a only a handful of papers devoted to graphene; this year there are more than 300 papers on this topic, owing to its interesting physical properties and potential microelectronic applications.

WEBSITE AND PRESSROOM
The main meeting website is http://meetings.aps.org/Meeting/MAR08/Content/1017. Complimentary press registration will allow science writers to attend all scientific sessions and exhibits. Public information officers are also welcome. If you wish to attend in person, you will need to fill out and return the form at the end of this release.
Here is information relating to the press operations at the meeting:
---The meeting pressroom will be located in exhibit hall area B2-2
---Pressroom hours: Mon-Thu, March 10-13, 7:30 a.m. to 5:30 p.m., March 14, 8:00 a.m. to noon;
---Pressroom phone numbers: 564-670-6800, x-6801, x-6802, and x-6803;
---Pressroom fax number: 564-670-6804;
---Breakfast and lunch food will be available in the pressroom Mon-Wed;
A PRESS CONFERENCE SCHEDULE WILL BE ISSUED IN SEVERAL WEEKS.

SHORT DESCRIPTIONS OF SOME TOPICS AT THE MEETING
To show off the diversity of forefront topics, here is a quick sampler of papers and sessions at the APS March Meeting. Longer descriptions of select sessions will follow further down in this press release.
-25th anniversary of scanning tunneling microscopes (session G1)
-New Orleans, Katrina, and the next big one (sessions H6 and V5)
-50th anniversary of Physical Review Letters (J2)
-APS prize sessions (E1, J1)
--Atomtronics: optical lattice-based diodes and transistors (paper B6.5,)
-Electrostatic and nanotech space radiation shielding (W35.12)
--Novel nanoscale direct writing with lasers and optically trapped microspheres (L23.5,)
--Shapes of optimal javelins and tall columns (A39.5)
--Sensors for harsh environments: nuclear reactors, deep space exploration, power plant (W5)

--Uncovering Racial Segregation Patterns in US High Schools (P39.8)
--Money circulation networks, data from wheresgeorge.com (U39.6)
--New method of detecting functional structure of brain networks (U39.7)
--Citation analysis: Beyond the Journal Impact Factor (U39.8)
--Studying Human Dynamics Through Web Analytics (U39.11)
--Which Route to Choose while Driving Home Tonight? (U39.12)
--Epidemic of a cell phone virus (U39.13)
--The Future of Scientific Publishing (J2.5)
--New encoding of qubits: it's easy if you can count to one (L15.1)
--Black holes as mirrors: information retrieval from evaporating black holes (P5.2)
--Squishy Physics Field Trips: peanut butter, toothpaste, and mayonnaise in the lab (J19.8)
--Preparing minority undergraduate students for successful science careers (U7.2)
--"Wow" is good, but "I see" is better---techniques for effective physics demonstrations (U7.3)
--Good news for diabetics: testing glucose levels without taking blood (U36.5)
-Talks by the 2007 physics Nobel prize winners-Fert and Gruenberg (L1)
-Michael Turner about the particle-cosmology connection (T1)
-Einstein's stolen brain (paper K1.239)
-Teaching physics to blind students (K1.227)
-Town hall meeting for scientists studying material at extreme pressures (T16)
-History of big industrial labs, such as IBM, Bell Labs, HP, and TI (V3)
-Restaurant networks and traffic tie-ups in Beijing (papers C1.254 and 282)
-Superfluid solids, or "supersolids" (A5)
-The physics of washboard roads (J8.1)
-Scientists in developing countries (J4)
-Gecko-inspired self-cleaning adhesives (C1.88)
-Tunable liquid mirrors (L9.1)

LONGER DESCRIPTIONS OF SELECTED TOPICS

OPTICAL LATTICES FOR QUANTUM COMPUTING
Quantum computing just got one stop closer with an advance in optical lattice technology. David Weiss (Penn State) will describe a 3D optical lattice partially filled with individual atoms at 250 sites. Ultimately, Weiss and his colleagues hope to use the atoms as qubits in a quantum computer. Unlike previous 3D lattices, the spacing between the atoms in the new system is large enough that the atoms can be individually manipulated with lasers and microwaves without disturbing neighboring atoms. The atoms' individual addressability and the fact that the atoms have multiple neighbors to quantum mechanically interact with make the system a promising route to quantum computing. (B6.4)

MATERIAL PHYSICS GETS OUT OF THE LAB
What do race cars, motorcycles, superheroes and steroids have in common? They're all topics addressed in session D3: Materials Physics in the Fast Lane. Charles Falco of the University of Arizona will start off the session with a look at the high-tech materials that help modern motorcycles achieve power-to-weight ratios a hundred times those of bikes built a century ago. Diandra Leslie-Pelecky (University of Nebraska), author of the forthcoming book "The Physics of NASCAR," follows, describing the science behind the cars, safety gear and tracks that are vital to stock car racing, the nation's most popular spectator sport. Roger Tobin of Tufts takes on a much more controversial subject as he analyzes the effects of illegal performance-enhancing drugs on homerun rates in baseball. NASA's John Wood describes the significance of the advanced optical glass that has made the Hubble Space Telescope one of the most important scientific tools in history. And finally, the author of "The Physics of Superheroes," James Kakalios (University of Minnesota), will talk about modern marvels that were once only the domain of comic book superheroes, including shape-memory materials, artificial retinas, and adhesive surfaces modeled on gecko feet.

GOLD, TIN AND LEAD BUCKYBALLS
Carbon buckyballs (fullerenes) are tiny spherical clusters of carbon atoms. The structures were first identified in 1985. But it was only two years ago that Lai-Sheng Wang (Washington State University and Pacific Northwest National Laboratory) and colleagues found that gold atoms could form similar spherical arrangements. Last year, Wang and his research group expanded the list of buckyball-forming elements by showing that tin and lead atoms could form into tiny spherical clusters, which they have respectively designated stannaspherene and plumbaspherene. Fullerenes are important in part because their properties can be adjusted by trapping other atoms at the center of the atomic cages. But some important elements interact strongly with gold and can't be trapped inside golden fullerenes, which limits the structure's potential for chemical applications. Tin fullerenes, on the other hand, can accommodate a number of important transition metal atoms and may end up being the most chemically versatile form of fullerenes discovered so far. (B21.5)

ARTIFICIAL NEURONS
The biophysics of neurons helps us understand how the brain works and suggests that artificial neurons may someday help in repairing or replacing damaged nerves. Donald Edwards (Georgia State University) will open session Y36, which is dedicated to various aspects of artificial neurons, with a look at a new software package called AnimatLab that allows researchers to construct models of neural circuits and test

their ability to mimic the movements of living creatures. Specific examples of AnimatLab studies will be presented by David Cofer (Georgia State University) in a talk about the mechanics of locust jumping (Y36.2) and Alexander Klishko (Georgia Tech), who has studied the extremely high accelerations cats' paws achieve when shaking in response to an irritating stimulus (A38.7). In talk Y36.7, Ranu Jung (Arizona State University) presents recent work on interfacing artificial neurons with damaged nerves in attempts to create neuroprosthetics. Other talks in the session describe a robot designed to mimic the locomotion of sea lampreys (Nikolai Rulkov, University of California, San Diego, Y36.3) and new ways to analyze neuronal activity (Y36.4, Y36.5, Y36.8, and Y36.11).

ANIMAL LOCOMOTION IN FLUIDS
Snakes, crabs and lizards … oh my? Georgia Tech researcher Daniel Goldman will talk about the Sandbot- a robot that can move on sand by mimicking the movement of sand crabs and lizards that run on water (D7.5). NYU researcher David Hu examines the slinky-like unidirectional motion of snakes; the constraints and advantages, and why their motion sometimes leaves them tied up in knots (D7.4).

RARE STOCK MARKET EVENTS, CELL PHONE PATTERNS, AND BATTLES
In a session dedicated to econophysics, Eugene Stanley (Boston University) will present research arguing that economic theories should include data outliers, often dismissed as "rare events" in their analysis (D39.7). These outliers actually occur in regular patterns when large amounts of data are considered, and their properties (like why they occur so far from the majority of the data) need to be explored. Data from earthquake analysis and financial fluctuations show examples of how so-called 'rare' outliers prove to be consistently common with larger amounts of data. Stanley shows that this theory is applicable across diverse markets and time scales. Marta Gonzalez of Northeastern University, on the other hand, applies the principles of econophysics in analyzing cell phone usage to show that all human mobility can be described by the same universal pattern, despite our individual travel habits. Cell phone usage offers a unique look into people's mobility patterns, previously considered too difficult to track. These patterns can be used in urban planning, traffic forecasting, epidemic prevention, understanding the spread of cell phone viruses, and emergency response activities (D39.3). Surajit Sen (SUNY) takes a look at army strategy and random events that could predict the most common outcomes between insurgents and defenders (D39.2).

CIRCUIT QED
Quantum electrodynamics (QED) is the most precise theory in all of physics, allowing tests of theory with experimental findings to levels of a part in a trillion or better. One sub-category of research is cavity-QED, in which the arena is a tiny cavity where basic interactions between atoms and photons, or photons alone, can be studied with great care. Recently a group of physicists at Yale in the group of Rob Schoelkopf accomplished two important feats that might help in the important endeavor to produce and process quantum bits (qubits) for future computers that handle quantum information. First, they produced a reliable source of single microwave photons; producing such photons by the million are easy, but not so easy if you want to make them singly on command. Second, they were able to transfer quantum information from one qubit to another along a wire; to be more precise the wire guided the photon (a virtual photon) from one place on a chip to another, the wire acting as a sort of common bus for moving information (for background, see Nature, 27 Sept 2007). The qubits (in effect bits consisting of a superpositions of both "0s" and a "1s") reside in the form of the presence (or absence) of a single photon in a tiny cavity. Now, Johannes Majer will report on progress of coupling superconducting qubits via a quantum bus. (Paper D5.3, lab website: http://www.eng.yale.edu/rslab/projects/cavity-bus-faq.html)

TOWARD GIGABAR PRESSURES
Several sessions and a so-called town meeting of practitioners will address the subject of producing ultrahigh pressures in laboratories or in simulating the effects of high pressure on various materials. Generally megabar (10^6 atm) pressures can be produced in the lab using either static pressure produced in a tiny anvil cell employing the facets of diamonds (up to about 5 megabar) or dynamic pressure produced in the form of shock waves. Laser driven shocks currently produce pressures in the tens of megabar (1 tera-pascal) range, but within a few years gigabar pressures will be accessible with lasers at the National Ignition Facility (NIF) in the U.S. and the Laser MegaJoule (LMJ) facility in France. Example of new results: Raymond Jeanloz of UC Berkeley will report on studies of liquid diamond (diamonds melted by laser light), which is metallic in nature. Jeanloz makes the point that the megabar pressures at work squeezing a material are equivalent to electron-volt-levels changes in the strengths of chemical bonding among neighboring atoms. In effect, he says, the periodic table properties of atoms are fundamentally altered by megabar pressures. All of this is magnified at gigabar pressures (equivalent to keV changes in bonding), where core-electrons, normally very reticent inside their atoms, become participants in the chemistry. (Paper T16.2)

NANOPARTICLES KILL TUMORS IN RATS
The ability to deliver drugs specifically to one part of the brain or some other specific tissue in the body is highly desirable in diseases like cancer, where the drugs may have widespread toxicity to healthy cells throughout the body. One nanotechnology-based approach to solving this problem was designed about 10 years ago by Raoul Kopelman (University of Michigan). Kopelman found a way of making tiny polyacrylamide particles about 60 nanometers in diameter that can be imbedded with drugs or other compounds and safely delivered to the bloodstream. Moreover, antibodies or other "targeting" molecules can be attached to the outside of the particles so that they can ferry this payload though the body and

dock at the tissues where the drugs are needed. In his talk, Kopelman describes one experiment where he and his colleagues decorated these particles with peptides that helped guide them into the nuclei of cancer cells in the brain, There, MRI contrast agents loaded in these nanoparticles helped image the tumor cells, and when illuminated by a laser, photodynamic chemicals inside the nanoparticles released highly-reactive singlet oxygen into the cancer cells, killing them. One 5-minute blast with simple red laser cured a few rats of glioblastoma, one particularly nasty form of brain cancer.

MICRO-OCEAN
An important part of the biosphere is the population of organisms, especially micro-organisms, which stand at the lowest level of the food chain but which dominates all others in terms of mass. At his MIT lab, Roman Stocker looks at such micro societies in ecological landscapes created on micro-fluidic chips. To marine bacteria, the ocean is a desert, a place where nutrients are scarce. Stocker will report on surprising signs that bacteria are much more efficient than was previously thought in their search for patches of nutrients. This might be an important step in studying how carbon and carbon dioxide are taken up in the ocean. (Paper P6.4; lab website at http://web.mit.edu/%20romanstocker/)

RECORD-SETTING SUBWAVELENGTH IMAGE TRANSMISSION
As a rule, images manipulated with lenses and mirrors cannot reveal details smaller than half the wavelength of light used to transmit them. Recently, many research groups have tried to break the resolution limit with new optical devices. Pavel Belov (Queen Mary University of London) and colleagues appear to have captured the subresolution flag with a system that can produce images with resolutions fifteen times smaller than the wavelength of the light used to create them, and transmit the images over distances 3.5 times the light's wavelength. The record was set with an array of parallel metallic rods that can be manufactured to work for wavelengths ranging from microwaves to mid-infrared light. Belov will report on the performance of the novel subwavelength system and discuss the potential for image magnification, data storage and other applications. (V28.5)

SWITCH ALTERNATIVES FOR MICROELECTRONICS
Miniaturization is the primary focus of most efforts to advance the state of the art in microelectronics. An added benefit of shrinking devices is that energy efficiency tends to improve dramatically as well, with one notable exception - even at tiny dimensions transistors are power-hungry components. Session S2 focuses on the increasing importance of finding alternatives to transistors in microelectronics. Eli Yablonovitch (University of California, Berkeley) will start the session off by considering a number of low voltage alternatives to transistors. Among the other speakers in the invited session, Joerg Appenzeller (Purdue) will consider solid state carbon nanotube devices, and Marc Baldo (MIT) will describe a prototype nanoscopic mechanical switch (also built of carbon nanotubes) that has the potential to eliminate losses characteristic of transistors, operate at low voltages, and run at much higher temperatures than typical of many silicon-based devices.

SOLAR CELLS: THE NEXT GENERATION
More silicon goes into the making of solar cells than into the making of microchips. Although accounting for only a tiny portion of overall electricity generation so far, solar cells are moving up quickly. For the past five years the amount of solar-generated electricity has increased by about 40% per year. Mass production of solar panels will help immensely in the overall long-term goal of bringing the cost of solar electricity down closer to that of coal-fired electricity. In the meantime, the things physicists can do are to explore new ways to make the cells more efficient and cheaper to produce. Session L2 is devoted to this effort. For example, one paper will consider the use of silicon nanocrystallites rather than more cumbersome (and expensive) single-crystal configurations used in present cells. Making cells from dye-sensitized paint components (titanium dioxide particles) is another route to cost reduction; the cells are somewhat less efficient than Si cells but are really cheap. Another paper looks at the use of quantum dots for utilizing solar radiation at certain infrared wavelengths that would otherwise be lost to the conversion process. One speaker will report on the use of high-efficiency (and more expensive) tandem solar cells and the use of concentrators to focus sunlight and reduce the cost. The issue of high efficiency is especially crucial for portable solar-powered devices that are being developed by the military for use by soldiers in the battlefield.

ETHICS TUTORIAL
A tutorial on ethics education will be held Sunday afternoon, just before the meeting starts. Journalists are welcome to attend. The tutorial was organized by Marshall Thomsen of Eastern Michigan University, where he has taught an ethics course for 20 years. The course is now required for undergraduate physics majors. He believes "that the vast majority of physicists want to be and intend to be ethical." The purpose of the tutorial will be to explore the many gray areas that can arise in doing research, and to review some specific examples of scientific misconduct.

****
SCIENCE WRITER REGISTRATION FORM
APS 2008 March Meeting
Email response to Phil Schewe
mailto:%22pschewe@aip.org%22

Please supply your name, institution, and email address:

_____ I shall attend the meeting.

_____ I cannot attend but please send me later press releases