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2006 APS April
Meeting in Dallas

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###Embargo notice### Please do not report on the results mentioned in this press release until the day and time the respective paper is delivered at the meeting.

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College Park, MD, March 6, 2006-----The April Meeting of the American Physical Society (APS) will occur April 22-25 in Dallas, Texas at the Hyatt Regency Hotel. This is the second of the two largest general physics meetings of the year. The first one, the APS March Meeting, takes place in Baltimore March 13-17 and is concerned with condensed matter, chemical, and biological physics. At the April Meeting, by contrast, the big topic areas are particle, nuclear, astro, and plasma physics. At last year's meeting in Tampa, all of these subjects played a part in what was arguably the biggest single result---the report of evidence for a sort of primordial quark-gluon liquid amid heavy-ion collisions carried out at Brookhaven's Relativistic Heavy Ion Collider (RHIC).

Here is a quick sampler of the subject diversity at the 2006 April Meeting: new results from Jefferson Lab's experimental look for strange quarks inside the proton (paper I9.1); RHIC as the world's first high-energy polarized proton collider (L2.1); energy issues, including climate, hybrid vehicles, and the present and future nuclear reactor industry (X5); progress reports on underground laboratories (B1), cold dark matter experiments at the LHC (X1.1); dark matter in the Milky Way's halo (X1.3); summaries of two major national studies, one a National Academy/DOE/NSF report on particle physics in the 21st century and the other a NASA/DOE/NSF look at dark energy (G1); radiation-resistant diamond detectors for use in high-volume, high-energy, quick-turnaround data-taking environments such as particle colliders (C1.1); assessment of a series of recently found unorthodox mesons (C2.1) which could be novel hybrid particles of some kind, or tetraquarks, or meson molecules; recent results from cosmic ray experiments, where energies (above 10^18 eV) put terrestrial accelerators to shame (H3.1); and evolution at several levels---the universe, our planet, and living organisms (Q5).

WEBSITE AND PRESSROOM

The April Meeting website is http://meetings.aps.org/Meeting/APR06/APS_epitome. Click on "epitome" to see the meeting program, including abstracts. One can search by topic, name, or affiliation. Make sure to scroll down; and you might have to click "enter" twice. Complimentary press registration will allow science writers to attend all scientific sessions. Public information officers, as usual, are welcome. If you wish to come, please

reply to Phil Schewe at pschewe@aip.org. Here is information relating to the press operations at the meeting:

---The meeting pressroom will be located in the Hyatt Regency, Cherokee Room.
---Press conferences will take place in the Hyatt Baker Room.
---Pressroom hours: April 22-24, 8 AM to 5 PM, April 25, 8-noon
---Pressroom phone numbers: 214-712-7049, 7048, 7047
---Pressroom fax number: 214-712-7050
---Internet hookups will be available.
---Breakfast and lunch food will be available in the pressroom Saturday-Monday
---a press conference schedule will be issued in early April

SOME EXPECTED HIGHLIGHTS AND STORY IDEAS FOR THE MEETING

RADIATION MARKERS

Physicists continue to find creative and useful applications for naturally and artificially created radiation. Vincente Guiseppe of the University of Maine will explain how radon-222, a naturally occurring radioactive gas dissolved in groundwater, can provide information on groundwater mixing and flow (B8.4). Taking advantage of the fact that fission energy reactors emit large numbers of antineutrinos, Nathaniel Bowden of Sandia and his colleagues will explain how these antiparticles might be useful for measuring the reactor's power and plutonium inventory through the reactor's fuel cycle (B8.3).

COSMIC RAYS AND BIODIVERSITY

The fossil record shows that Earth's biodiversity fluctuates on an approximately 62-million-year cycle. Until now, there has been no satisfactory explanation for this biodiversity oscillation. University of Kansas researchers Mikhail Medvedev and Adrian Melott show that this cycle can be explained by a change in the flux of cosmic rays reaching Earth as the solar system moves through the galactic plane. This is due to differences is shielding by galactic magnetic fields, and to variations in cosmic ray production and propagation the galactic interstellar medium. Cosmic rays can influence cloud formation and atmospheric chemistry, and thus affect climate. In addition, energetic cosmic rays produce showers of energetic particles that can damage organisms' DNA. Other astrophysical phenomena, such as Gamma Ray Bursts and supernovae, also have an effect on biodiversity. In a separate talk Melott will present some new data quantifying some of these effects. (H7.1 and H7.4)

PLENARY TALKS

Three slates of plenary presentations will cover a cosmic range of physics topics: At session A1, what Voyager 1 and 2 are up to at the edge of the solar system; the study of quark gluon plasma; and results from the MiniBoone neutrino experiment. At session O1: the cosmological role of neutrinos; learning about astrophysical plasmas through experiments on Earth; and the physics, engineering, and social implications of cochlear implants. At session V1: carbon nanotubes; the search for gravity waves with LIGO;

and physics and engineering issues for the prospective International Linear Collider. Although they aren't listed as plenary talks, the presentations in Session B4, aimed at undergraduate physics majors, should be just as good. Topics include the search for the Higgs boson, why the expansion of the universe is accelerating, and how objects---such as Brazil nuts and M&M's---fit into a vessel.

HIGH-ENERGY MACHINES

Particle physics usually means high-energy physics since discerning the subtle logic of submicroscopic matter requires beams of high potency. Highlight sessions include J1, which centers around the 10th anniversary of the top quark discovery, and the latest results from exclusive home of lab-made top quarks, Fermilab's Tevatron machine. Session C14 looks at a novel accelerator scheme where beams of muons (heavy cousins of electrons) would be collided. Colliding beams of electrons with beams of heavy ions (session J2) is still another way to probe matter, especially in this case, for looking at the quark content of protons and the nucleus in general. The principal accelerators on the horizon are the Large Hadron Collider (LHC), presently under construction at the CERN lab in Geneva (H5, L1), where high energy protons will be collided head on, and the International Linear Collider (ILC), where electrons would be collided. ILC is not yet approved but seems to be gathering more support (sessions E1, Q6, and other sessions) among scientists as the natural complement to LHC.

HOW ROUND IS A PULSAR?

Pulsars---spinning neutron stars that emit radio pulses---are some of the most spherical objects in the sky. Generally, however, physicists could only measure the shapes of the stars indirectly, by watching the rate that a pulsar's rotation slows. Data from LIGO (Laser Interferometer Gravitational Wave Observatory), a pair of enormous gravitational wave detectors in Livingston, Louisiana and Hanford, Washington, has now placed limits on the shape of pulsars, including the one at the heart of the Crab nebula, through attempts to directly detect gravitational waves coming from the stars. Matthew Pitkin (matthew@astro.gla.ac.uk) of the University of Glasgow,on behalf of the LIGO Scientific Collaboration, will present the analysis of the most recent and most sensitive LIGO data collected so far, as well as discussing the limits that the current and forthcoming LIGO data puts on pulsar shapes (C7.2).

ILLICIT NUCLEARISM

The APS Szilard Prize will be given to Paul Richards (Columbia University), who will talk about how nuclear detonations can be discerned from a daily background consisting of 1000 earthquakes and chemical explosions (S4.2). Another APS honor, the Burton Award, will be presented to David Albright (Institute for Science and International Security), who will speak on the topic of Pakistan's AQ. Khan and the illicit nuclear trade.

SAKHAROV IN THE GRAY ZONE

The battle for protecting the human rights of scientists did not end with Andrei Sakharov and the Former Soviet Union--it is still going on today. Session L6 will explore programs to support and provide safe haven for scholars persecuted for their speech, ethnicity,

gender, and citizenship. Yuri Orlov, who is the first recipient of the APS Sakharov Prize, helped establish Human Rights Watch and was one of the early defenders of Sakharov. He will describe "difficult areas of human rights activity in which human rights defenders cannot reach a consensus on how to proceed, and even on how to define the problem." An Iranian physicist sentenced to 10 years of prison for advocating democracy and openness, Hadi Hadizadeh, now at Ohio University, will describe the closed-door trials that he and fellow scholars experienced in Iran. Hadizadeh will describe continuing threats for Iranian scholars and other political activists who have expressed criticisms of the Tehran government. Another talk will focus on the Scholars at Risk Network (SRN), an academic coalition now headquartered at New York University. Robert Quinn of SRN will explain the network's efforts to provide refuge for scientists persecuted in their home countries.

ASTROPHYSICS IN THE LABORATORY

Plasma physicists have produced in a laboratory some of the extreme conditions and fascinating phenomena observed in the sun and in space. Plasmas and magnetic fields in space often form loops, which merge, twist and reconnect, releasing energy and jets of particles. This magnetic reconnection is believed to underlie many solar phenomena, but scientists don't have a complete understanding of how it works, and the details can be hard to study in space. In an experiment at Swarthmore College, Michael Brown (doc@swarthmore.edu), along with a group of undergraduate researchers, generates and merges loops of extremely hot gas suspended on magnetic fields. These loops have many properties of the much larger loops observed on the surface of the sun, including temperatures up to 1 million degrees, strong magnetic fields, and high velocities. Brown and colleagues have used hundreds of tiny magnetic detectors to map out the entire complex 3-dimensional structure of loops in the process of intertwining and reconnecting. Brown will compare this structure, which had never been mapped out before, to similar structures in reconnecting magnetic fields in the magnetosphere. In their newest measurement, the Swarthmore researchers used Doppler spectroscopy to measure high-velocity (40km/s), bi-directional jets coming out of a reconnection event. Interestingly, the researchers say, this same technique has been applied to the surface of the sun by the SOHO satellite, which has observed a similar bi-directional flow both towards the earth and down towards the solar surface. Brown will report on his observations and compare them to observations in a solar context (L16.4). In another talk, Hantao Ji of the Princeton Plasma Physics Lab will describe new advances he has made in understanding fast magnetic reconnection in a laboratory plasma. (E3.2)

ABRUPT CLIMATE CHANGE

Beyond reducing the burning of fossil fuels, many things can be done to lower energy consumption and mitigate CO2 emissions. Arthur Rosenfeld, eminent physicist, energy-efficiency researcher since the early days (1970s), and a member of the California Energy Commission, will show how principles of building design, especially of roofs, can reduce energy consumption (see www.ucop.edu/facil/greenbldgs/documents/rosenfeld.pdf). Another speaker at session W5, Danny Day (Eprida), will discuss two large-scale "negative emissions" processes for lowering anthropogenic CO2. These two carbon

sequestration approaches are the agricultural (production of biofuels) and the geological (underground storage).

WHY ARISTOTLE TOOK SO LONG TO DIE

Aristotle's view of physics and cosmology reigned for many centuries as the definitive model of physical reality among the philosophical thinkers of Islam and Christendom, even after Copernicus and Galileo came on the scene. Dennis Danielson (Univ. of British Columbia) considers why this was and suggests how, by attempting to see things from Aristotle's point of view, we might be better able to "avoid getting stuck in our own orthodoxies" when it comes to untangling nature's mysteries. (B5.1)

FUNDING RESEARCH IN POOR COUNTRIES

International scientific collaboration and research programs have a largely unrealized potential to promote innovation and economic development in poor countries. But as session C4 will show, governmental (eg, the National Science Foundation or the Humboldt Foundation) and public/private programs (eg, the US Civilian Research and Development Foundation) are reaching out to a wider range of nations and world regions than before. At the session, Arden Bement, director of the National Science Foundation, will talk about NSF's international outreach through a variety of initiatives in Africa (e.g., the Materials Science Network) and elsewhere. At session E4, officials from UNESCO, the World Bank, and NSF's International Science and Engineering Division will discuss burgeoning efforts to develop science, technology, and education programs for reducing poverty in developing nations. Reza Mansouri, former deputy minister for research in the Iranian government and now a visiting professor at McGill, will explain how excellence in science can accelerate the process of democracy.

PARITY VIOLATION: 50TH ANNIVERSARY

The discovery that nature can tell the difference between left and right---in other words, the finding that parity is not conserved in weak-nuclear interactions---had a big impact on physics in the 1950s. Sessions E5 and P10 recount how this happened. Two of the speakers are C. N. Yang (SUNY-Stony Brook, Emeritus) and T.D. Lee (Columbia), who won Nobel prizes for their efforts in this discovery. Another is Leon Lederman (former director of Fermilab), who will describe a hectic experiment of his performed over a frantic 36-hour period.

CLICKERS IN THE CLASSROOM

Numerous sessions at the meeting feature research aimed at improving science education. In paper S10.5, Brian Pyper of Brigham Young University will describe classroom experiments with "clickers," modern personal-response systems that students can use during lectures to answer questions and provide feedback. Following up on a June 2005 study showing benefits of using the clickers (Reay et al., American Journal of Physics, June 2005), Pyper reports that subsequent, more in-depth experiments with the clickers have indicated interesting information about how students are able to gauge their own learning, and have revealed different approaches to physics material by gender. (S10.5)

COUNTER-TERRORISM

Much of the technology in place and under development to keep us safe from terrorism here at home and weapons proliferation around the globe is based on fundamental physics principles. Detectors that alert us to radioactive materials, biological threats, chemical weapons, and explosives are all adapted from tools developed primarily to aid in physics research. Methods for detecting the shocks that accompany weapons tests and satellite-based monitoring systems also began as research tools. Edward Hartouni (hartouni1@llnl.gov) of the Lawrence Livermore National Laboratory will describe how some detection systems may violate personal liberties, offend cultural sensibilities, or simply fail to specifically identify threats. He will also discuss ways that detection schemes could be made more effective for ensuring national and international security (C10.3).

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