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2005 APS April Meeting in Florida
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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.

College Park, MD, March 4, 2005-----The April Meeting of the American Physical Society (APS) will occur April 16-19 at the Marriott Waterside Hotel in Tampa, on the lovely west coast of Florida. This is the second of the two largest general physics meetings for the year. The first one, the APS March Meeting, will take place in Los Angeles March 21-25, and is concerned chiefly with physics in bulk material, such as semiconductors, fluids, and living organisms. The April Meeting, by contrast, goes to the extremities of the size scale: quarks and nuclei at the one end, and at the other end galaxies and the cosmos as a whole.

At the particle end, numerous sessions are devoted to the exploration of reality at its finest scale---the search for extra dimensions, the study of B quarks, top quarks, neutrinos, and those important but elusive particles known as supersymmetric particles and the Higgs boson. Frank Wilczek (MIT), one of the 2004 physics Nobel laureates and an insightful writer about physics, will talk about why gravity is so ridiculously weak (Paper K4.1). Brian Greene, author of the best-selling books "The Elegant Universe" and "The Fabric of the Cosmos," will summarize the latest findings of string theory (Paper K1.4). The noted string theorist Hessamaddin Arfaei of the Institute for Studies in Theoretical Physics and Mathematics in Tehran will deliver the Beller Lecture. (He might well be the only physicist with an Iranian passport at the meeting, owing to visa problems.)

The April Meeting is also rich in astrophysics sessions. All the big topics will be represented: gamma ray bursts, cosmic rays, the search for gravity waves, dark matter, extrasolar planets, energetic phenomena at the galactic center, and the first results from the Levitated Dipole Experiment, an Earthbound experiment that aims to recreate the conditions of magnetospheres of planets such as Jupiter (K5.2). Depending on the current state of analysis new results might be available from the Wilkinson Microwave Anisotropy Probe (WMAP) (session B2) and from the Swift orbiting gamma telescope (K3.2), which made the first detection of the bright (briefly brighter than the full Moon) gamma burst in December of 2004. Michael Turner (NSF) will look at the imperative of major international collaboration on several scientific mega-projects (M6.1).

In this, the international World Year of Physics, honoring the centenary of Albert Einstein's three great papers on relativity, the photoelectric effect, and Brownian motion, numerous sessions are devoted to Einstein and his legacy. Sessions F1 and J4 are devoted to cosmology, gravity, and the search for departures from general or special relativity. Session J5 considers Einstein's collaboration with several other scientists. In addition, Lawrence Krauss of Case Western (and author of "The Physics of Star Trek") will give the World Year of Physics 2005 public lecture which is entitled "Einstein's Biggest Blunder: A Cosmic Mystery" (Monday, April 18, 7:30pm, Marriott Hotel, Grand Salon F).

Physicists have been long known for their attention to social issues, especially in security matters. Notable session topics in this regard are the weaponization of space (B6), nuclear weapons and nuclear terrorists (H6), a session (T6) at which Lawrence Krauss will, besides giving his Einstein talk, deliver the Burton Award lecture for his efforts to defend science against "intelligent design" proponents. At the same session the Szilard Award lectures will be given by four physicists for their work on countering nuclear threats.

The extremely busy Dr. Krauss will also be part of a session (K6) devoted to science and government, where his talk is entitled "Scientific Integrity in Washington: Politics Trumps Science." The other two speakers are President Bush's science advisor, John Marburger, whose talk is entitled "Scientific Integrity in Government," and Kurt Gottfried of Cornell whose talk is called "Science Meets Politics---from Thomas Jefferson to George W. Bush."

WEBSITE AND PRESSROOM

The April Meeting website is http://meetings.aps.org/Meeting/APR05/Content/65. Click on "epitome" to see the meeting program, including abstracts. One can search by topic, name, or institution (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 Marriott room 2
- Press conferences will take place in the Marriott room 3
- Pressroom hours: April 16-18, 8 AM to 5 PM, April 19, 8-noon
- Pressroom phone numbers: 813-314-6444, -6445, -6446, -6671

- Pressroom fax number: 813-314-6675
- Breakfast and lunch food will be available in the pressroom Saturday-Monday; breakfast only on Tuesday.
- a press conference schedule will be issued in early April

SOME EXPECTED HIGHLIGHTS AND STORY IDEAS FOR THE MEETING

Deep Galaxies

The DEEP2 project, headquartered at UC Berkeley and UC Santa Cruz, is a large galaxy-redshift survey mapping the location of 50,000 galaxies. Unlike the Sloan Digital Sky Survey and 2dF, prominent surveys which look at relatively nearby galaxies (out to redshift of about 0.2), DEEP2 centers its attention farther out, to a time about halfway back to the Big Bang (redshifts around 1). At the meeting Marc Davis (mdavis@berkeley.edu) will report on new findings about the clusters of galaxies at that redshift and might, depending on the progress of data analysis, be able to provide the best astrophysical test yet (by a factor of ten in precision) of the proposition that the fine structure constant---a parameter which sets the intrinsic strength of the electromagnetic force---has been changing down through the eons. (Paper U3.1)

Quantum Loops and the Black-Hole Information Paradox

Like its rival, string theory, loop quantum gravity aims to reconcile the venerable but incompatible theories of general relativity, which describes the universe at large scales, and quantum mechanics, which describes nature at the atomic scale. Unlike string theory, which starts off by assuming space-time is smooth and continuous, loop quantum gravity assumes fundamentally that space-time at the smallest scales is discontinuous and chunky. The fabric of space-time is literally woven by quantum threads and is best described by a "quantum geometry." Abhay Ashtekar, the director of Penn State's Institute for Gravitational Physics and Geometry, will present a detailed solution to the so-called "information-loss paradox" associated with black holes. Last July, Stephen Hawking declared that information indeed does not get lost from an evaporating black hole, but did not present explicit details of why this is the case. Ashtekar and colleague Martin Bojowald find that the effects of loop geometry resolve this issue and show how information can be recovered. String theorists also conclude that information is not lost. But according to Ashtekar, loop quantum gravity is the only theory that provides a space-time picture of how this happens. (T10.1)

Uptake of Radioactive Iodine in the Thyroid of a Mouse

In parts of the United States and elsewhere potassium iodide (KI) tablets have been made available for use by humans so as to load the thyroid with stable iodine in the event of an accidental or terrorist-triggered release of radioiodine. An interdisciplinary collaboration among physicists and biologists at the College of William And Mary (W&M) and the DOE's Thomas Jefferson National Accelerator Facility (JLab) has been studying the effectiveness of ordinary KI in blocking the absorption of radioactive iodine in the thyroid of a mouse. The W&M/JLab scientists routinely use the isotope iodine-125 to conduct medical and biological imaging in mice using special gamma-ray imagers. The technique is direct, permitting spatial resolution as small as 1 mm and minute-by-minute observation of metabolism of tagged materials through the animal's body. It is also humane; the mouse is only briefly anesthetized and later eliminates most of the absorbed activity harmlessly. In studies of the appropriate dose for blocking radioiodine uptake in the mouse thyroid, the researchers have drawn comparisons between the usual human dose of KI and the amount needed to achieve blocking in a mouse in relative proportion to weight. The research has shown that the human-recommended KI blocking dose, when scaled to a mouse, mostly blocks uptake of radioactive iodine. However, the researchers also find fairly clear signs that, in mice at least, a higher dosage provides better protection. (Paper E12.5; contact William Hammond, W&M, wthamm@wm.edu)

Search for ExaVolt Neutrinos

Neutrinos made inside the sun from nuclear fusion reactions typically have energies of mega-electron volts (MeV). But theorists expect that other, more powerful, processes might endow nu's with energies of 10^ 18 eV (one Exa-electron-volt, or EeV) or more. The Antarctic Impulsive Transient Antenna (ANITA) is a designed to detect exactly this sort of particle. ANITA consists of an array of antennas mounted on a balloon flown above the Antarctic icecap. The detection scenario is as follows: an incoming EeV neutrino passes through the Earth, where it interacts and looses a cascade of energetic particles which zoom up through the icepack, where they emit Cerenkov radiation, which is recorded by ANITA overhead. Peter Gorham (808-956-9157, gorham@phys.hawaii.edu) will present the first ANITA results, obtained with a prototype detector flown at the South Pole. He will discuss individual events, if any are found, as well as limits that the data will place on various cosmological theories and hypotheses about the existence of extra spatial dimensions. (http://www.phys.hawaii.edu/~anita/ ; Paper C1.3)

NeutrinoFest

A workshop for science writers on the topic of neutrinos will be offered at the Marriott Waterside Hotel on Monday, April 18, from 11 AM to 4 PM. Speakers will include Janet Conrad of Columbia, Joe Lykken of Fermilab, and K.C. Cole of the Los Angeles Times. If you want to attend please RSVP to conrad@nevis.columibia.edu. For more information contact James Riordon at APS, jriordon@aps.org

Do We Really Understand Gravity?

The only evidence for dark energy and dark matter comes through their gravitational effects. Some physicists wonder, then, whether the evidence in favor of dark matter and dark energy isn't pointing instead to a breakdown in an understanding of gravity, currently inherited from Einstein in the form of his general theory of relativity. The answer is probably "no," but physicists at Session E4 are finding it worthwhile to speculate on alternatives. Hiranya Peiris of the University of Chicago (hiranya@cfcp.uchicago.edu) will cover some of the best cosmological observations, especially of the microwave background, and how they can be used to constrain novel theories of gravity. Arthur Kosowsky of Rutgers (kosowsky@physics.rutgers.edu) will discuss dark matter and possible alternatives -- primarily, whether the idea of modified gravity is a better fit to cosmological dynamics than the idea of dark matter. And Mark Trodden of Syracuse University (trodden@physics.syr.edu) will take a similar tack towards the acceleration of the universe, which is usually taken to indicate the presence of dark energy. According to session organizer Sean Carroll of the University of Chicago (carroll@theory.uchicago.edu), "It's quite possible that the hypotheses of dark matter and energy are in fact much less profound than what is really going on, so it's important to take these speculative possibilities as seriously as we can."

Plenary Lectures

Three sessions (A0, Q0, W0) of premier speakers talking about premier topics are planned. These include Leonard Susskind (Stanford), who will speak about what happens to information when it approaches a black hole. Nobel laureate Carl Wieman (Colorado) will describe the creative tension between a professor's devotion to teaching and to research. Other speakers and topics: Felix Aharonian (Max Planck Institute, Heidelberg) on TeV gamma rays, Evelyn Hu (UC Santa Barbara) on nanostructures, Hendrik Schatz (Michigan State) on the creation and destruction of rare isotopes, Chris Quigg (Fermilab) on a new way (which he calls the "double simplex" in analogy with DNA's double helix) to describe elementary particle interactions, and Wendy Freedman (Carnegie Observatories) on recent cosmological discoveries.

Is the Pentaquark an Endangered Species?

For decades, physicists had only seen evidence that quarks clump in groups of two and three. In the last three years, however, experiments produced evidence for exotic four- quark (tetraquark) and five-quark (pentaquark) states. On the heels of a dozen "positive" sightings of the pentaquark (at facilities such as SPring8 in Japan and Jefferson Lab in Virginia), there has been a flurry of negative ("null") results, most containing better statistics, from experiments including CDF at Fermilab, BaBar at SLAC, and collaborations at CERN in Switzerland and DESY in Germany. Curtis Meyer of Carnegie Mellon (cmeyer@ernest.phys.cmu.edu) will review the current evidence for and against the pentaquark. (E2.2)

Plato and Particle Physics

The atom idea, enunciated by Greek thinkers Leucippus and Democritus in 5th century (BCE) Greece, has proven tremendously fruitful in explaining the material fabric of the cosmos. Nowadays the standard picture of matter employs a periodic table to sort out atomic elements up to uranium and beyond. Each of these atom species is known to possess electrons in orbit around a heavy nucleus, which itself is made of protons and neutrons. The latest and finest differentiation of matter is the recognition that protons and neutrons themselves have constituents, namely quarks, which cannot exist singly. Rupert Machleidt of the University of Idaho (machleid@uidaho.edu, 208-885-6380) revives an argument made by Werner Heisenberg that Plato was closer to modern particle physics than was Democritius. The difference between atomism and elementary particle physics, Machleidt says, is that in our modern theory the assembly of composite particles isn't just a matter of stacking blocks but of observing certain symmetries preferred by nature. In Plato's day, the periodic table consisted of four elements: earth, water, air, and fire. These elements consisted of atoms shaped like tiny cubes, icosahedrons, octahedrons, and tetrahedrons, respectively. According to the Platonic "quark model," these classic 3D polyhedra could be made from just two shapes: equilateral and isosceles triangles, which are 2D shapes that couldn't constitute 3D atoms except in combinations. (Paper R13.1)

Plasma Acceleration

Accelerating charged particles to high energies is usually achieved by boosting the particles in powerful electromagnetic fields supplied by microwave devices. An alternative method, with potentially much higher acceleration gradient, is to use waves moving through a column of plasma to boost electrons to high energies. Chandra Joshi (cjoshi@ucla.edu) of UCLA, working at the SLAC machine at Stanford, will report on the present ability to impart energy gains of 4 GeV over only a 10-cm length of plasma and plans for achieving soon a gain of 10 GeV over a length of a third of a meter (Paper U5.1)

How Relativity Came to China

Special relativity first passed into China in 1917 by Chinese scientists who had been trained in Japan. Special and general relativity did not become better known, however, until later in the 1920s, by which time the first generation of Chinese theoretical physicists had graduated from European and American universities. P.Y. Chou (PhD from Caltech, 1928), a postdoctoral fellow with both Heisenberg and Pauli, helped to bring quantum mechanics to China. Danian Hu (danianhu@yahoo.com) of the City College of New York will discuss the developments and other examples of Chinese physics research up to the time of the Communist revolution in 1949 (Paper R13.3).

Catching a Gravitational Wave.

Two major scientific collaborations are well on their way to testing Einstein’s predictions in general relativity by searching space for gravitational waves, which could come from black holes, neutron stars and radio pulsars, among other objects. Various scientists from the LIGO collaboration will present new science and technical results. On the horizon is the planned space-based Laser Interferometer Space Antenna (LISA), which will be sensitive to gravitational waves in the mHz band. Several speakers will discuss potentially powerful sources, including massive black hole binaries and globular cluster systems (B10, C4).

Space-Based Warfare.

Space has long been exploited for commercial, civil scientific and military uses, but the current administration’s vision for space also includes additional missions for satellites, including ballistic missile defense, according to Laura Grego of the Union of Concerned scientists, one of three speakers at a Saturday morning session on space weaponization and missile defense. She will discuss security issues and the technological feasibility of some of this new vision. Leonard Weiss of the Federation of American Scientists will present the main conclusions of the FAS report on space-based weapons, while Philip E. Coyle III, senior advisor with the Center for Defense Information, will review the latest test results for boost-phase missile defense (B6).

Weighing Photons--and an Einstein Hypothesis--with Lightning Bolts

The modern notion that the photon has absolutely no mass rests on Einstein's 1905 postulate that the speed of light is a universal constant. In efforts to confirm precisely the weightless nature of the photon, Martin Fuellekrug, now at the University of Bath (M.Fullekrug@bath.ac.uk), has developed a new method to put the photon on the balance and his method finds an upper limit of 4*10^-52 kg for its mass. The trick in the method is to observe 5-50 Hz radio waves, which are transmitted by naturally occurring lightning flashes in thunderstorms. Tiny deviations between experiment and theory are attributed to a mass limit for the photon. These tiny deviations depend on the sun's highly dynamic output, which manifests itself as "space weather": The sun's shortwave radiation and energetic charged particles bombard the Earth's atmosphere and continuously alter its conductivity at 90-100 km height, where the radio waves are reflected and modified. These space weather phenomena are not yet understood well enough to bring the photon mass to zero. But as scientists try to find out in the future how tiny the mass of the photon really is, they can contribute at the same time to an improved understanding of space weather and a better protection of space based technology. (U13.2)

These items were put together by Phil Schewe, Ben Stein, and Jennifer Ouellette.