2006 APS April Meeting

Dallas, TX

http://www.aps.org/meet/APR06

Saturday, April 22, 2006 8:30AM - 10:18AM –

Session A1 APS: Plenary Session I Hyatt Regency Dallas Landmark A

8:30AM A1.00001 Exploring the Final Frontier of the Solar System EDWARD STONE, California Institute of Technology — In December 2004 at 94 AU, Voyager 1 crossed the termination shock marking the abrupt slowing of the supersonic solar wind and began exploring the region where the solar plasma presses outward against the local interstellar medium. The flow in this region is much slower than expected and the turbulence is different than in the supersonic solar wind. In contradiction to many predictions that the shock was the source of medium energy anomalous cosmic rays, their intensity did not peak at the shock, indicating their origin remains to be discovered. However, the shock is the source of low energy ions that reveal new aspects of the acceleration process. Recent results from Voyager 2 at southern solar latitudes suggest that the shock may be 7 to 10 AU closer than at Voyager 1 in the north, consistent with an asymmetric distortion of the heliosphere by a local interstellar magnetic field. The Voyagers will provide more insight into this outermost region of the heliosphere and what lies beyond as they continue their journeys to interstellar space.

9:06AM A1.00002 Nature's First Liquid: The Quark Gluon Plasma , BARBARA JACAK, SUNY, Stony Brook — High energy collisions of nuclei recreate the high energy densities that existed a few microseconds after the Big Bang. Matter under such conditions is expected to be a plasma of quarks and gluons not confined inside hadrons. The Relativistic Heavy Ion Collider (RHIC) produces such matter in the laboratory, and its behavior has proven to be quite surprising. Examination of thousands of particles in the final state yields evidence for very rapid thermalization leading to a dense, opaque, collectively flowing system. The degrees of freedom cannot be hadrons and the interactions are not those expected for asymptotically free quarks. Rather, the matter behaves like a liquid with low viscosity, as may be expected for some plasmas. I will review experimental results and discuss insights into the properties of the produced matter.

9:42AM A1.00003 Accelerator-based Neutrino Oscillation Studies: Present and Future , HIROHISA TANAKA, Princeton University — The study of neutrino oscillations using accelerator-based beams is entering a renaissance. Experiments on three continents aim to elucidate the nature of this phenomenon in its entirety as part of a world-wide program involving both accelerator and non-accelerator techniques. Neutrino oscillations represent the first evidence of physics beyond the Standard Model; the results will have profound implications for not only particle physics, but our understanding of how the universe evolved to its current state. The MINOS and upcoming OPERA and ICARUS experiments aim to confirm our understanding of the atmospheric neutrino phenomenon via oscillations and precisely measure its parameters. These experiments will be followed by the T2K and proposed NOvA experiments, which will search for a third, as-yet unobserved mode of oscillation that may hold the key towards understanding how antineutrinos differ from neutrinos and the hierarchy of their masses. Meanwhile, MiniBooNE at Fermilab is searching for oscillations indicated by the LSND experiment that would indicate a complete break from the Standard Model. Such new physics could take the form of heretofore unseen sterile neutrinos or exotic forms of symmetry breaking that would dramatically change the landscape of particle physics.

Saturday, April 22, 2006 5:30PM - 7:00PM –

Session F1 APS: APS Welcome Reception Hyatt Regency Dallas Union Station, Grand Hall

5:30PM F1.00001 APS Welcome Reception –

Sunday, April 23, 2006 2:00PM - 3:00PM –

Session K15 APS: Panel Discussion with PR/PRL Editors Hyatt Regency Dallas Cumberland K

2:00PM K15.00001 Panel Discussion with PR/PRL Editors — The panel will include Editors from the Physical Review and Physical Review Letters journals. They will briefly discuss some current issues facing the journals, such as possible actions in response to the report of the PRL Review Committee. The perennial topic of education of referees and authors, and how to deal with relentless growth. Opinions on these issues, and others, will be solicited from the audience. The Editors will also respond to questions and comments.

Sunday, April 23, 2006 5:15PM - 6:45PM –

Session M1 APS: APS Award Presentations, Past President's Address, and Lilienfeld Prize Talk Hyatt Regency Dallas Landmark A

5:15PM M1.00001 Award Presentations –

5:45PM M1.00002 APS Past President's Address: Looking Back on the World Year of Physics 2005 , MARVIN COHEN, University of California, Berkeley and Lawrence Berkeley National Laboratory — I had the privilege of being APS President during the celebration of the World Year of Physics 2005. I will describe some of my experiences and discuss some perspectives about APS and about physics.

6:15PM M1.00003 Lilienfeld Prize Talk: Persistent Challenges of Quantum Chromodynamics , MIKHAIL SHIFMAN, University of Minnesota — Unlike some models whose relevance to Nature is still a big question mark, Quantum Chromodynamics will stay with us forever. Quantum Chromodynamics (QCD), born in 1973, is a very rich theory supposed to describe the widest range of strong interaction phenomena: from nuclear physics to Regge behavior at large E, from color confinement to quark-gluon matter at high densities/temperatures (neutron stars); the vast horizons of the hadronic world: chiral dynamics, glueballs, exotics, light and heavy quarkonia and mixtures thereof, exclusive and inclusive phenomena, interplay between strong forces and weak interactions, etc. Efforts aimed at solving the underlying theory, QCD, continue. In a remarkable entanglement, theoretical constructions of the 1970s and 1990s combine with today's ideas based on holographic description and strong-weak coupling duality, to provide new insights and a deeper understanding.

Monday, April 24, 2006 8:30AM - 10:18AM –

Session O1 APS: Plenary Session II Hyatt Regency Dallas Landmark A

8:30AM O1.00001 Highlights of Neutrinos in Cosmology , NICOLE BELL, CalTech — Neutrinos play unique roles in many epochs of the Universe's evolution. Important information can be gleaned from neutrino evolution during the big bang nucleosynthesis era, while at later times neutrinos have a significant impact on the cosmic microwave background and large scale structure power spectra. For example, cosmological data now place the tightest constraints on neutrino mass, though there is scope to evade these limits if the physics of the neutrino sector is non-standard. We outline the wealth of information that can be revealed by studying the sea of relic neutrinos.

9:06AM O1.00002 Plasma Turbulence in Astrophysics and in the Laboratory[1] , WILLIAM DORLAND, Department of Physics, University of Maryland — Turbulence plays a critical role in plasma systems ranging from laboratory fusion experiments to astrophysics. In nearly collisionless systems, modeling this turbulence is challenging because of the kinetic nature of the dominant dissipation processes and because of the strong nonlinear interactions that control the dynamics. On the other hand, the range of spatio-temporal scales that must be simultaneously resolved is not as large as in neutral fluid turbulence. A new class of "gyrokinetic" codes developed for fusion are facilitating the exploration of plasma turbulence across a broad range of problems. In fusion applications, fluctuations driven by local pressure gradients cause energy and momentum to leak from the magnetic containers shielding hot plasma from the cold surrounding surfaces. A major surprise from the models is that transport may be dominated by self-generated, small-scale streams that convect the high temperature extended distances across the confining magnetic field. Experiments are now being carried out to search for these streams. In astrophysics an important issue is how large-scale turbulent energy is absorbed as it cascades to small spatial scales. Whether the energy is dumped into electrons or ions in accretion flows and other applications impacts both the dynamics of the system and our ability to interpret observations through measurement of radiation from distant sites throughout the universe. Results from the first self-consistent calculations of the collisionless absorption of turbulent energy cascades for astrophysical applications will be presented.

[1]This work supported in part by the Center for Multiscale Plasma Dynamics

9:42AM O1.00003 Bringing Hearing to the Deaf–Cochlear Implants: a Technical and Personal Account , IAN SHIPSEY, Purdue University — Cochlear implants are the first device to successfully restore neural function. They have instigated a popular but controversial revolution in the treatment of deafness, and they serve as a model for research in neuroscience and biomedical engineering. In this talk the physiology of natural hearing will be reviewed from the perspective of a physicist, and the function of cochlear implants will be described in the context of historical treatments, electrical engineering, psychophysics, clinical evaluation of efficacy and personal experience. The social implications of cochlear implantation and the future outlook for auditory prostheses will also be discussed.

Tuesday, April 25, 2006 8:30AM - 10:18AM –

Session V1 APS: Plenary Session III Hyatt Regency Dallas Landmark A

8:30AM V1.00001 The Science of Nanotubes , ALEX ZETTL, University of California, Berkeley; Lawrence Berkeley National Laboratory — Nanotubes formed from carbon or boron nitride have highly unusual electronic and mechanical properties. Depending on composition and geometry, they range from excellent metals to wide-bandgap semiconductors. They can be grown with length-to-diameter aspect ratios exceeding 10 million, and are axially exceptionally stiff yet form nearly ideal frictionless bearings. This talk will address the exciting basic science as well as applications of nanotubes and nanotube-based nanoelectromechanical systems.

9:06AM V1.00002 Searching for gravitational waves with LIGO , GABRIELA GONZALEZ[1], Louisiana State University — The LIGO gravitational wave observatories are now taking data, having reached their design sensitivity. The LIGO scientific Collaboration is actively searching the data for signals from rotating stars, from stochastic backgrounds, from binary neutron star and black hole systems, and from transient sources like supernovas and collisions of black holes. We will show the sensitivity achieved by the detectors and present the latest results in the search for gravitational waves. We will also describe the worldwide effort for present and future detectors.

[1]for the LIGO Scientific Collaboration

9:42AM V1.00003 Matter, Energy, Space and Time: The International Linear Collider Physics Prospects and International Aspects , ALBRECHT WAGNER, DESY — Over the past century, physicists have sought to explain the character of the matter and energy in our universe, to show how the basic forces of nature and the building blocks of matter come about, and to explore the fabric of space and time. In the past three decades, experiments at laboratories around the world have given us a precise confirmation of the underlying theory called the *standard model*. These particle physics advances have a direct impact for our understanding of the structure of the universe, both at its inception in the Big Bang, and in its evolution to the present and future. The final synthesis is not yet fully clear, but we know with confidence that major discoveries expanding the standard model framework will occur at the next generation of accelerators. The Large Hadron Collider (LHC) being built at CERN will take us into the discovery realm. The proposed International Linear Collider (ILC) will extend the discoveries and provide a wealth of precision measurements that are essential for giving deeper understanding of their meaning, and pointing the way to further evolution of particle physics in the future. A world-wide consensus has formed for a baseline ILC project at energies of 500 GeV and beyond. The choice of the superconducting technology as basis for the ILC has paved the way for a global design effort which has now taken full speed.