

University of Washington
Physics Colloquium Schedule
Winter Quarter 2006



*Mondays, 4:00 P.M. Ronald Geballe Auditorium, Rm. A102
Coffee & cookies at 3:45 P.M. in the lobby*

www.phys.washington.edu/colloquia.htm

~Winter Quarter Colloquium Chair: Professor Eric Adelberger~

Special Colloquium, Thursday, January 4

Ed Daw, University of Sheffield (Astro/Gravitational Physics Faculty Candidate)

Title: *"The Hunt for Gravitational Waves"*

Abstract: Gravitational waves are oscillations in the geometry of space resulting from cataclysmic astrophysical events, from supernova explosions to the coalescence of pairs of neutron stars to the big bang singularity at the birth of the Universe. I will describe interferometric detectors, both existing and planned for the future, whose aims are the direct detection of gravitational waves and the study of the ultra-dense, energetic sources that generate them.

January 8

Dave Pritchard, MIT.

Title: *"Precision Mass Measurement: $\omega_{\text{cyclotron}}$ is not qB/m , does $E=mc^2$?"*

Abstract: We have developed an ion balance that has improved atomic and molecular mass measurement accuracy to $\sim 10^{-11}$. It compares the cyclotron frequency of two individual molecular or atomic ions trapped in a uniform magnetic field to find the mass ratio. Besides improving the mass of fundamental particles, this has led to discovery of a correction to the cyclotron resonance formula, a new route to determining the fine structure constant using simple physics, the best measurement of the dipole moment of any charged molecule, recalibration of the x-ray wavelength standard, a possible route to replace the artifact kilogram with an atomic mass standard, and a precise test of $E=mc^2$. We can also weigh chemical bonds.

January 15

Holiday, no colloquium

January 22

Speaker: Andy Haas, Columbia University (Elementary Particle Experiment Faculty Candidate)

Title: *"The Search for the Higgs - An Opening to New Physics"*

Abstract: The Higgs boson is the final particle of the Standard Model which has yet to be observed. Experiments at the Fermilab Tevatron are actively searching for signs of this elusive particle. Details of the data analyses and prospects for the future will be discussed. But there is reason to believe that the picture will be different, more complicated and interesting, than in the Standard Model.

Therefore we also search for other Higgs boson signatures, such as those that could occur in a world with low-energy supersymmetry. Results from these analyses at the Tevatron will be shown, and prospects for an alternative search at the newly-commissioned ATLAS experiment at the Large-Hadron Collider at CERN will be shown.

Special Colloquium, Thursday, January 25

2:30P.M., Room C520

Speaker: Miguel Morales (Astro/Gravitational Physics Faculty Candidate)

Title: *"Observing the Epoch of Reionization"*

Abstract: Highly redshifted 21 cm neutral hydrogen emission from the Epoch of Reionization (EOR) is a unique cosmological probe, and planned low frequency radio observations could revolutionize our understanding of structure formation and the emergence of the first luminous objects. However, EOR observations are complicated by strong foreground contamination and stringent instrumental requirements. In this talk, I will review the observational signatures of the Epoch of Reionization and how the faint 21 cm emission can be extracted from the foreground signals, and describe the Mileura Widefield Array - Low Frequency Demonstrator (MWA-LFD) my colleagues and I are constructing in Western Australia.

January 29

Speaker: Craig Hogan, University of Washington

Title: *"The New Science of Gravitational Waves with LISA"*

Abstract: The Laser Interferometer Space Antenna (LISA) will directly sense motions of distant matter by detecting vibrations in spacetime called gravitational waves (unlike all of science up to now, which has studied the universe using particles and fields, such as electromagnetism). In LISA's broad frequency band around a millihertz, the universe is richly populated with strong gravitational wave sources. The strongest will be hundreds of inspiral and merger events of massive binary black holes, which LISA will detect with signal to noise ratio of well over 100 from the whole history of galaxy formation back to

redshift of about 20. These events record the dynamics of strong-field relativity--pure vacuum spacetime interacting with itself. They are the most violent possible occurrences in physics; each event has a peak power of around 10^{49} watts or 1000 times more than all the stars in the universe. Nevertheless, LISA waveforms give precise, gravitationally calibrated measurements of all the parameters of the systems: their masses, spins, orbital parameters, and even their direction and distance to much better than one percent precision. The talk will summarize the new opportunities for exploration and discovery in physics, astrophysics, astronomy, and cosmology that will emerge from LISA, and give a brief synopsis of the mission design and implementation status.

February 5

Speaker: Chao-Lin Kuo, Caltech (Astro/Gravitational Physics Faculty Candidate)

Title: *"CMB Beyond the Acoustic Peaks"*

Abstract: Together with other cosmological probes, observations of the cosmic microwave background (CMB) radiation have been used to determine standard cosmological parameters with high precision. Much more information is needed, however, to understand the link between the outlandish Lambda dominated-CDM Universe and fundamental physics. In the first part of the talk, I will describe several ongoing CMB experiments targeting the high- l power spectrum and the B-mode polarization anisotropies. These ground- and balloon-based experiments highly compliment the WMAP satellite in survey parameters and science goals. In the second part of the talk, I will describe the CMB detector development efforts at JPL/Caltech, with emphasis on the antenna-coupled transition edge sensors (TES), a technology now reaching maturity. The next generation CMB experiments enabled by this new technology will look even deeper in the B-mode polarization to pursue the imprints of the primordial gravitational background radiation left by Inflation.

Special Colloquium, Thursday, February 8, PAT Room C520

Speaker: Vadim Rusu, Stanford University (Elementary Particle Experiment Faculty Candidate)

Title: "Beyond the Horizons: A quest for New Physics"

Abstract: For the last 40 years, the Standard Model of Particle Physics had great success in describing the experimental data obtained. None the less, questions remain. There are hints that physics beyond the Standard Model exists in the TeV regime. Discovering it, will change our view of the Universe. At 2 TeV center-of-mass energy, the Tevatron is currently the best place to attempt to find this new physics. I will present our search for physics beyond the Standard Model in the large CDF datasets acquired at the Tevatron. I will describe the motivation and choice of an experimental signature, the challenges posed by a hadron collider environment and the interesting results obtained.

February 12

Speaker: Oliver Buchmueller, CERN

Title: *"Search for New Physics at the Large Hardron Collider at CERN"*

Abstract: After a machine-commissioning phase in the 2007, the 27 km long Large Hardon Collider (LHC) at CERN (Geneva/Switzerland) will begin colliding protons at a center-of-mass energy of 14 TeV, becoming the world's highest energy particle collider. The main goals of the LHC are the search for the Higgs boson, the last remaining undiscovered particle of the Standard Model of particle physics, and the search for physics "beyond the Standard Model". I will talk about what we expect to see, what we might see, and how we do it.

February 19

Holiday, no colloquium

Special Colloquium, Tuesday, February 20, 2:30pm PAT Room C520

Speaker: Anna Goussiou

Title: *"Unraveling the Mysteries of Nature in the Smallest Dimensions"*

Abstract: What the universe is made of and how it works have always been the basic questions in the heart of particle physics. In the last several years, impressive developments in astrophysics and cosmology have made these questions more broad and more pressing than ever. How does the quantum world connect to the cosmic scale? What is the structure of space-time? Do all the forces become one? High-energy particle accelerators constitute a powerful tool in the quest to understand the nature of the universe, by recreating the particles and forces of its early state. As an example, I will present the case of the electroweak symmetry and how we are striving to understand it at the highest energy, current and soon-to-come-online, accelerators.

February 26

Speaker: Blayne Heckel, University of Washington

Title: *"Preferred Frame and CP-Violation Tests with a Spin-Polarized Torsion Balance"*

Abstract: We used a torsion pendulum containing 1023 polarized electrons to search for CP-violating interactions between the pendulum's electrons and unpolarized matter in the earth or the sun, to test rotation and boost-dependent preferred-frame effects using the earth's rotation and velocity around the sun, and to search for exotic velocity-dependent potentials between polarized electrons and the sun. Experimental constraints on these spin-dependent couplings will be presented along with a description of the experiments and the means by which the spin density of the pendulum was determined.

March 5

Speaker: TBA

Title: TBA

Abstract: TBA

The University of Washington is committed to providing access, equal opportunity and reasonable accommodation in its services, programs, activities, education and employment for individuals with disabilities. To request disability accommodation contact the Disability Services Office at least ten days in advance at: 206-543-6450/V, 206-543-6452/TTY, 206-685-7264/Fax, or dso@u.washington.edu