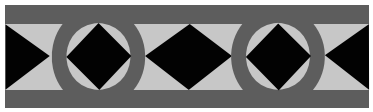
University of Washington

Physics Colloquium Schedule

Autumn Quarter 2005



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
~Autumn Quarter Colloquium Chair: Professor Ann Nelson~

October 3 **Jamie Nagle, University of Colorado Boulder**
"Quark Gluon Plasma Physics"
Abstract: At very high temperatures we expect protons and neutrons to melt into a novel system of quarks and gluons - termed the quark-gluon plasma. We will describe an experimental program to characterize nuclear matter at the highest possible temperatures achievable in the laboratory. Results from the Relativistic Heavy Ion Collider have revealed many surprises including possible connections with unexpected areas of physics. Energies an order of magnitude higher will be available at the Large Hadron Collider in the next few years, and a preview of this new energy regime will also be described.

October 10 **Eric Mazur, Harvard**
"*Wrapping Light around a Hair: Manipulating Light at the Nanoscale"*
Abstract: Can light be guided by a fiber whose diameter is much smaller than the wavelength of the light? Can we mold the flow of light on the micrometer scale so it wraps, say, around a hair? Until recently the answer to these questions was ?no?. We developed a technique for drawing long, free-standing silica wires with diameters down to 50 nm that have a surface smoothness at the atomic level and a high uniformity of diameter. Light can be launched into these silica nanowires by optical evanescent coupling and the wires allow low-loss single-mode operation. They can be bent sharply, making it possible to control the propagation of light around micrometer-sized corners. The nanowires have applications in microphotonic devices for optical processing and environmental sensing.

October 17 **Sean Carroll, University of Chicago**
"Beyond Dark Energy"
Abstract: General relativity is inconsistent with cosmological observations unless we invoke components of dark matter and dark energy that dominate the universe. While it seems likely that these exotic substances really do exist, the alternative is worth considering: that Einstein's general relativity breaks down on cosmological scales. I will discuss models of modified gravity, tests in the solar system and elsewhere, and consequences for cosmology.

October 24 **Daniel Kleppner, MIT**
"National Missile Defense and the Safety of the United States"
Abstract: The United States is deploying an untested missile defense system designed to ntercept intercontinental-range ballistic missiles in mid-flight. An alternative system is also being developed in which missiles are intercepted while their rocket engines are still burning, before they could deploy multiple warheads or decoys. The American Physical Society has carried out a study of the feasibility of this approach. I will describe the technical issues involved in

attempting to implement such a system and provide personal observations on how missile defense relates to the safety of the United States.

October 31 **Alan Nathan, University of Illinois at Urbana-Champaign**

"The Physics of Hitting a Home Run"

Abstract: For a baseball fan, there are few things more satisfying than hearing that sharp distinctive crack of the bat announcing that the ball is on its way to the centerfield seats. For a physicist, there are few things more satisfying than figuring out how something works. And for a physicist who is also a baseball fan, it is pure ecstasy to have figured out much of what is going on during that very brief instant of time when ash meets cowhide. I will try to convey a bit of that excitement as I step you through the physics of hitting a home run. I will focus on two broad topics: the physics of the ball-bat collision and the aerodynamics of the ball in flight. In doing so, I will address various practical issues from a physics point of view, such as the "sweet spot" of the bat, the role of the batter's grip during the collision, the differences between wood and aluminum bats, and the role of spin in the flight of the ball. My goal is that all who attend (from physics novices who happen to be baseball fans to full professors) find something of interest in this talk, whether it be baseball, physics, or the link between them.

November 7 ***Joint Physics/PNNL Colloquium***

Richard Kouzes, Pacific Northwest National Laboratory

"Detection of Nuclear Threats at Borders"

Abstract: Countries around the world are deploying radiation detection instrumentation to interdict the illegal shipment of radioactive material crossing international borders at land, rail, air, and sea ports of entry. These efforts include deployments in the US and a number of European and Asian countries by governments and international agencies. Items of concern include radiation dispersal devices, nuclear warheads, and special nuclear material. Radiation portal monitors (RPMs) are used as the main screening tool for vehicles and cargo at borders, supplemented by handheld detectors, personal radiation detectors, and x-ray imaging systems.

Some cargo contains naturally occurring radioactive material that triggers "nuisance" alarms in RPMs at these border crossings. Individuals treated with medical radiopharmaceuticals also produce nuisance alarms and can produce cross-talk between adjacent lanes of a multi-lane deployment. The operational impact of nuisance alarms can be significant at border crossings. Methods have been developed for reducing this impact without negatively affecting the requirements for interdiction of radioactive materials of interest.

This talk discusses the experience to date on interdiction of radioactive materials at borders.

November 14 ***Graduate Student Invited Speaker***

Shiraz Minwalla, Harvard and Tata Institute

"*Black Holes in Yang Mills Theories"*

Abstract: According to the AdS/CFT correspondence, certain large N gauge theories may be reformulated as theories of gravity. It follows that black holes - perhaps the most enigmatic of all gravitational objects - have a dual manifestation in large N gauge theories. In this talk I will identify, construct and explore these dual black holes in several examples. This identification provides a new and potentially fruitful perspective on old puzzles of black hole physics like the information paradox.

November 21 **Toby Burnett, University of Washington Department of Physics**

"*The Approach of a New Era in Gamma Ray Astronomy: the GLAST Instrument"*

Abstract: The gamma-ray sky, for energies above 30 MeV, has been relatively poorly studied. Most of our current knowledge comes from observations made by the EGRET detector on the Compton Gamma Ray Observatory, which produced many discoveries, opening up a new field of astronomy. It found that the luminosities of many objects peak in this energy band, that the spectra of gamma-ray bursts extends to at least GeV energies, and that intense flares are a

common feature of many gamma-ray sources.

This talk will focus on the three periods in the life of a gamma ray: How is it produced, which requires extreme environments in astrophysical objects, or new physics like WIMP dark matter annihilation; what can be learned as the photon propagates to us, absorption or dispersion; and how we detect it, with a discussion of the design of the successor to EGRET, GLAST.

GLAST, for Gamma-ray Large Area Space Telescope, is a satellite-based experiment to measure the cosmic gamma-ray flux in the energy range 20 MeV to >300 GeV. With a sensitivity that is more than a factor 30 greater than that of EGRET, many more sources will be detected.

I have been involved in GLAST for more than 10 years; I'll point out the impact that the UW group has had on the design and development of the now-complete instrument. Launch is less than two years away!

November 28 **Josh Klein, University of Texas**

"Exploring Neutrino Oscillations with Continuous Sources"

Both the first evidence and the first discoveries of neutrino flavor transformation have come from experiments which use neutrino `beams' provided by Nature. The discoveries were possible because these experiments are naturally sensitive to a broad range of physics, including the completely unexpected. Yet the time between the initial evidence and final confirmation of the discoveries underscores the fact that such experiments are also particularly challenging. I will discuss here the approaches and results of these `continuous source' experiments, in particular those of the Sudbury Neutrino Observatory, and will include a discussion of some of the future measurements planned using solar neutrinos and nuclear reactor antineutrinos.

December 5 ***Boris Jacobsohn Lecture***

Janet Conrad, Columbia

"*Seeking the Small Silent Type*"

Abstract: One of the great breakthroughs in physics of the past decade has been the evidence for neutrino mass from neutrino oscillation experiments. However, incorporating these tiny masses into the Standard Model is not straightforward. Many extensions which include neutrino mass also introduce beyond-standard-model interactions. This talk considers how this new physics may be observed in oscillation experiments. It focuses on the MiniBooNE experiment, which is presently taking data and which may shed light on the question.

December 12 **Finals Week**
