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202 NICHOLSON HALL
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Baton Rouge, Louisiana 70803-4001

WEEKLY CALENDAR

March 28, 2011

Departmental Colloquium

Thursday, 3:40 PM, March 31, 2011
109 Nicholson Hall

"Black Holes and Exotic Materials"

Sean Hartnoll

Harvard University and Stanford University

Host: Parampreet Singh and Jorge Pullin

• *Refreshments served at 3:15 PM in 232 (Library) Nicholson Hall* •

The description of states of matter whose excitations remain strongly interacting at arbitrarily low energy scales remains a serious challenge for theoretical physics. Yet such exotic states of matter are believed to underlie some nonconventional superconductors and other important materials. Recent work has used the tools of the string theoretic 'Holographic Duality' to study these systems. I will give an overview of Holographic Duality its potential usefulness in this context. I will discuss attempts to use black hole physics to describe, via the duality, the emergence of superconductivity from a strongly correlated state as well as non-Fermi liquids and so-called 'metallic quantum criticality'.

Special Seminar

Monday, 3:40 PM, March 28, 2011
109 Nicholson Hall

"Teaching a SmartPET new tricks"

Helen Boston

University of Liverpool

Host: Kip Matthews

• *Refreshments served at 3:15 PM in 232 (Library) Nicholson Hall* •

Technological and detector advances coupled with new analysis tools that have evolved from blue sky nuclear structure research have the capacity to be of significant benefit to society.

Position sensitive semiconductor detectors coupled with digital electronics can be deployed for medical physics, security, industry and nuclear decommissioning to name but a few capabilities.

The Small Animal Reconstructive Positron Emission Tomography (SmartPET) high purity Germanium detectors at the University of Liverpool were initially designed to use position sensitive planar detectors to show proof of principle that semiconductor detectors can be used in PET imaging. In PET a 3D image of the distribution of radiation internal to a patient can be produced by collecting the collinear 511keV gamma rays produced in positron annihilation.

Due to the excellent energy resolution afforded by these types of detectors the two SmartPET detectors were reconfigured into Compton Camera mode for use in Single Photon Emission Computed Tomography (SPECT). SPECT is another functional imaging modality used in nuclear medicine for cancer and dementia diagnosis and normally uses radioisotopes that decay via one path way emitting a singular gamma ray to build up a 3D image.

Compton kinematics and cone beam reconstruction are used in conjunction with position sensitive detectors to locate radiation internal or external to the body. With the excellent energy resolution of the semiconductor detectors spectroscopic information can also be gathered which opens up the possibility of these systems being used not only for medical imaging but also for security and nuclear waste management and decommissioning.

The principles of Compton camera imaging and Pulse Shape Analysis (PSA) along with gamma ray tracking which aid in the location of radiation will be given. Current projects based at the University of Liverpool in conjunction with industrial partners will be discussed to demonstrate the capability of Compton cameras. In addition initial images will be presented

Publications:

1. "Exact Analysis of Disentanglement for Continuous Variable Systems and Application to a Two-Body System at Zero Temperature in an Arbitrary Heat Bath," G. W. Ford and R. F. O'Connell, Journal of Computational and Theoretical Nanoscience, Vol. 8, 331-337, 2011.