LSU College of Science Department of Physics & Astronomy

WEEKLY CALENDAR

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Louisiana State University
Baton Rouge, Louisiana 70803-4001

WEEKLY CALENDAR

February 18 - 22, 2013

DEPARTMENTAL COLLOQUIUM

"Advancing tumor molecular diagnostics using a new protein-based imaging technique: Amide Proton Transfer MRI"

3:30 PM, Monday, February 18, 2013
109 Nicholson Hall

Guang Jia
The Ohio State University

Host: Wayne Newhauser
• Refreshments served at 3:10 PM in 232 (Library) Nicholson Hall •

Amide proton transfer (APT) MRI has been emerging as a novel protein-based molecular imaging technique using endogenous contrast for oncologic imaging. We advanced this methodology to a clinically applicable approach and assessed its feasibility for quantitative assessment in different oncologic tumors. Patients were enrolled for assessment of the following primary malignancies in the pelvis, lung, liver, pancreas, and eye. All patients were imaged on a 3 Tesla MR system. The APT-MRI signal-based detection and quantification of endogenous cellular protein concentrations was shown to be a promising marker to improve tumor characterization as well as visualization. Malignant lesions consistently reveal higher signals due to their increased cellular content of mobile proteins. The capability of the APT-MRI approach to detect characteristics of malignancy has the potential for improved imaging-based cancer management for clinical diagnosis and therapy assessment.

DEPARTMENTAL COLLOQUIUM

"Performance of Curved Detectors with Pinhole Collimation for Cardiac SPECT"

3:30 PM, February 21, 2013
109 Nicholson Hall

Joyoni Dey
University of Massachusetts Medical School – Dept. of Radiology

Host: Wayne Newhauser
• Refreshments served at 3:10 PM in 232 (Library) Nicholson Hall •

SPECT is primarily used in the clinic for myocardial perfusion imaging. However, for conventional SPECT, sensitivity is low requiring 10-20 mins of acquisition times. System resolution is poor as well. New dedicated Cardiac systems including those with multi-pinhole collimation has shown higher sensitive acquisitions. We show in theoretical simulations as well as GATE studies with point sources and mathematical anthropomorphic (NCAT) phantoms that further gains in sensitivity and/or resolution maybe achieved by using curved detector with each pinhole.

Time permitting, other topics will be covered as well, such as "Penalized Maximum Likelihood Iterative Reconstruction for Sub-wavelength Nano-scale Optical Computed (Projected) Tomography (SNOCT)", where a forward model for a optical projection microscope is build for a possible system geometry design and an iterative reconstruction algorithm is investigated for isolated cell imaging.

PUBLICATIONS:

1. "Measurement of the nu e and total 8B solar neutrino fluxes with the Sudbury Neutrino Observatory phase-III data set", **Thomas Kutter** and Jason Goon, Phys. Rev. C Editor's Suggestion.
   http://prc.aps.org/pdf/PRC/v87/i1/e015502

LA-SiGMA

Louisiana Alliance for Simulation-Guided Materials Applications

Spring Seminar Series
3:30pm - 4:30pm, Wednesday, February 20, 2013
Johnston Hall 338, Louisiana State University

Deliberate Discovery of Missing Materials and the "Inverse Problem": Given a Desired, Target Property, Find the Structure

by

Prof. Alex Zunger

University of Colorado

Condensed matter physics and material research has historically often proceeded via trial-and-error or even accidental discoveries of materials with interesting physical properties, including new ferromagnets, superconductors, magneto–resistors, transparent-conductors, carbon nanotubes, etc., etc. The question posed in this talk is: does it make sense instead to first declare the physical property you really want, then find which structure/material has this property? I will describe recent advances in the way quantum-mechanical electronic structure calculations have been combined with biologically-inspired ("genetic") evolutionary approaches to scan a truly astronomic number of atomic configurations in search of the one that have desired, target electronic properties ("Material Genome Initiative"). Recent examples of such "*Inverse Design"* in the areas of nanostructures, magnetism, semiconductors and spectroscopy will be mentioned. This work was also borne out of the recognition that many materials that can be expected to exist, are in fact missing from the compilations of all materials previously made. Are they missing for a good reason (i.e., they are intrinsically unstable), or did people did not get around to making them yet, but they could have interesting properties? I will describe the way modern "first principles thermodynamics" can address this question, and in the process discover quite a few inorganic structures and materials that *should* exist, but are yet undiscovered. Experimental efforts to make such materials are underway in the newly formed "Energy Frontier Research Center on Inverse Design."

Prof. Alex Zunger research field is "Theory of Real Materials", and a pioneer in the field now called "First Principles Theory of Solids". He has applied this technique in the past ~30 years to a broad range of materials classes (semiconductors, insulators, metals, molecular crystals), geometries (nanostructures, surfaces, interfaces, alloys), and properties (spectroscopic, thermodynamic, structural). This work has been recognized by some of the leading awards in physics including the year 2012 (inaugural) *"Material Theory Award" of the MRS*; the *John Bardeen award of The TMS*, the *Rahman Award of the American Physical Society*, the *Gutenberg Award* for science (Germany), as well as the upcoming (year 2013) *Hume-Rothery Award* on theory of alloys. He mentored 77 postdoctoral fellows, published over 600 papers in refereed journals, including over 150 in Physical Review Letters and Rapid Communication. His papers have received over 50,000 citations, and his high "*h-index"* is over 100 (100 of his papers were cited each at least 100 times). He is the author of the fifth-most-cited paper in the 110-year history of Physical Review (out of over 350,000 articles published in that journal). He pioneered the science of materials by design now used in the "Materials Genome Initiative" (MGI) established the "Energy Frontier Research Center on Inverse Design" – a USA Office of Science Center involving more than 40 researchers. He is its Chief Scientist, working at the University of Colorado, Boulder.