LSU LOUISIANA STATE UNIVERSITY

PHYSICS & ASTRONOMY
WEEKLY CALENDAR

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202 NICHOLSON HALL
Louisiana State University
Baton Rouge, Louisiana 70803-4001

WEEKLY CALENDAR

October 8-12, 2012

DEPARTMENTAL COLLOQUIUM

"Landing Curiosity on Mars with Flight"

3:30 PM, October 11, 2012
130 Howe-Russell

Keith Comeaux
NASA's Jet Propulsion Laboratory

Host: Michael Cherry

• Refreshments served at 3:00 PM in 232 (Library) Nicholson Hall •

The Mars Science Laboratory (MSL) carries the most advanced payload of scientific gear ever used on Mars' surface, a payload more than 10 times as massive as those of earlier Mars rovers. Its mission includes investigating whether conditions have been favorable for microbial life and for preserving clues in the rocks about possible past life.

The intense period called the entry, descent and landing (EDL) phase of the mission, otherwise known as the "seven minutes of terror" spans the trajectory from the top of the Martian atmosphere, traveling at about 13,200 miles per hour (5,900 meters per second) to about seven minutes later when Curiosity is stationary on the surface. From just before jettison of the cruise stage, 10 minutes before entry, to the cutting of the sky crane bridle, the spacecraft goes through six different vehicle configurations and fires 76 pyrotechnic devices, such as releases for parts to be separated or deployed. In addition to using guided entry to land more precisely than ever before, MSL employs the largest supersonic parachute ever used at Mars, and relies on the novel Sky Crane architecture to land Curiosity using its mobility system as natural landing gear.

Curiosity began surface operations soon after landing in Gale Crater on 6 August, 2012, and will continue for at least one Mars year (approximately two Earth years). The overall scientific goal of the mission is to explore and quantitatively assess a local region on Mars' surface as a potential habitat for life, past or present. Curiosity is designed to carry ten scientific instruments and a sample acquisition, processing, and distribution system. The various payload elements will work together to detect and study potential sampling targets with remote and in situ measurements; to acquire samples of rock, soil, and atmosphere and analyze them in onboard analytical instruments; and to observe the environment around the rover.

Keith Comeaux, PhD, flight director during Curiosity's landing, will describe the mission's objectives, its science payload suite, the landing sequence and first 50 sols of operations on Mars.

PUBLICATIONS:

1. "Self-adjointness in the Hamiltonians of deparametrized totally constrained theories: A model," Rodolfo Gambini and **Jorge Pullin**, Physical Review D86, 067501 (2012).

2. "Radiation reaction: general approach and applications, especially to electrodynamics," **R. F. O'Connell,** in Contemporary Physics 53 (4), 301-313 (2012).

LA-SiGMA

Louisiana Alliance for Simulation-Guided Materials Applications

Fall Seminar Series

3:30pm - 4:30pm, Wednesday, October 10, 2012

Johnston Hall, Room 338

Spin-Orbit Tuned Ground States in Single-Crystal Iridates

by

Prof. Gang Cao

University of Kentucky, Lexington

The most profound result of the ***spin-orbit interaction*** (SOI) on iridates is the ***J_{eff}=1/2 insulating state***, a new quantum state that represents the novel physics in the 5*d*-based systems. The SOI vigorously competes with Coulomb interactions, non-cubic crystal electric field and Hund's rule coupling, and critically biases their mutual competition to stabilize ground states with exotic behavior, which sharply contrasts with traditional models. Indeed, two conspicuous phenomena are commonly observed among layered iridates: **(1)** the J_{eff} = ½ insulating state, and **(2)** relatively high magnetic ordering temperatures and complex magnetic states that are not predicted by existing models. In this talk, we review the underlying physical properties of the layered iridates (e.g., $Sr_{n+1}Ir_nO_{3n+1}$ with n = 1, 2, 3, $BaIrO_3$, doped Ca_2IrO_4, etc.), and report results of our study that emphasizes spin-orbit-tuned ground states stabilized by chemical doping, application of pressure and magnetic field. These weak perturbations are capable of directly reducing the SOI so as to rebalance comparable interactions to generate a rich phase diagram of strongly competing ground states controlled by the SOI.

*Professor Gang Cao is Gill Eminent Professor of Physics at the University of Kentucky and APS Fellow. His research interests focus on discovery and study of novel electronic materials, particularly physical properties of single-crystal materials at high magnetic fields, high pressure and ultralow temperatures. Professor Cao is currently Director of the Kentucky Center for Advanced Materials.