College of Science
Department of Physics & Astronomy

Weekly Calendar and News

February 13-18, 2017

202 Nicholson Hall
Baton Rouge, LA 70803
TEL: 225-578-2261
http://www.phys.lsu.edu

Departmental Colloquium

ΛCDM Cosmology:
Successes, Challenges, and Opportunities for Progress

Joel Primack
University of California, Santa Cruz
Host: Juhan Frank

3:30 PM Thursday, February 16, 2017
119 Nicholson Hall
• Refreshments served at 3:10 PM in 232 (Library) Nicholson Hall •

The modern standard cosmological theory ΛCDM is remarkably successful in predicting the cosmic microwave background and large-scale structure, and ΛCDM parameters have been determined with only mild tensions between different types of observations. Hydrodynamical simulations starting from cosmological initial conditions are increasingly able to capture the complex interactions between dark matter and baryonic matter in galaxy formation. Simulations with relatively low resolution (EAGLE, Illustris) now succeed in describing the overall galaxy population. It once seemed that galaxies are pretty smooth, that they generally grow in size as they evolve, and that they are a combination of disks and spheroids. But recent HST observations combined with high-resolution hydrodynamic simulations are showing that most star-forming galaxies are very clumpy; that galaxies often undergo compaction, which reduces their radius and increases their central density; and that most lower-mass star-forming galaxies are not spheroids or disks but are instead elongated when their centers are dominated by dark matter. I will also review ΛCDM challenges on smaller scales: cusp-core, “too big to fail,” and substructure issues. Although starbursts can rapidly drive gas out of galaxy centers and thereby reduce the dark matter density, it remains to be seen whether this or other baryonic physics can explain the observed rotation curves of the entire population of dwarf and low surface brightness galaxies. If not, perhaps more complicated physics such as self-interacting dark matter may be needed. But standard ΛCDM appears to be successful in predicting the dark matter halo substructure that is now observed via gravitational lensing and breaks in cold stellar streams, and any alternative theory must do at least as well.

LSU Physics & Astronomy in the News

- Professor E. Ward Plummer named first U.S. physicist to receive international science award.
  http://www.lsunow.com/daily/lsu-professor-named-first-american-physicist-to-receive-international-science/article_bb9ad5aa-ecf9-11e6-b260-ef600f399f16.html

- "Dr. Wayne Newhauser combats cancer with 3D printing technology" in 225 Magazine. https://www.225batonrouge.com/community/dr-wayne-newhauser-combats-cancer-3d-printing-technology

- "Dr. Gabriela González uncovers the secrets of the cosmos" in 225 Magazine. https://www.225batonrouge.com/community/dr-gaby-gonzalez-uncovers-secrets-cosmos.

Publications:

- "What is physics? The individual and the universal, and seeing past the noise" by A.R.P. Rau

Events

- **Southwest Quantum Information and Technology-19th Annual SQuInT Workshop** Late Registration Deadline: February 23, 2017

- **LSU undergraduate research symposium - Deadline Approaching! Applications are due February 20, 2017**

- **LaCNS Seminar:** Neutrons and Numbers: The VISION challenge. The world's first high throughput Inelastic Neutron Scattering Spectrometer
  When: Monday, February 13, 2017 3:00 PM
  Where: 1008B Digital Media Center

Please see the attached flyer

LACNS

Louisiana Consortium for Neutron Scattering

SEMINAR SERIES 2017

Guest Speaker

Dr. Ramirez-Cuesta

Chemical Spectroscopy Group Leader

Oak Ridge National Laboratory

Free and open to the public

Monday, February 13
3:00 pm
1008B Digital Media Center
Louisiana State University

Neutrons and Numbers: The VISION challenge. The world's first high throughput Inelastic Neutron Scattering Spectrometer

The recently commissioned VISION spectrometer at the SNS in Oak Ridge Tennessee has an increased overall flux at low energy transfers up to 4000 times over its predecessors and it has unprecedented sensitivity. I will examine the limits of what is now possible in Inelastic Neutron Scattering thanks to VISION. From the determination of INS spectra of publishable quality in minutes (for samples in the gram quantity range), measuring the signal of samples in the milligram range to the direct determination of the signal of 2 mmol of CO_2 adsorbed on functionalized catalysts.

Sample environment developments are a crucial part of an effective neutron scattering program, at VISION we have developed the world's largest single crystal diamond anvil cell and measured the INS spectra of 1 mm^3 of a HMB sample. Gas handling experiments are trivial to perform. A sample changer designed for VISION is being built, it is a whole new concept that will allow continuous operation for large number of samples (hundreds at a time) that will enhance the mail-in program for sample measurement. Recently, a simultaneous Raman and INS center-stick has been developed and tested in VISION measuring simultaneously the rotational spectra of hydrogen in the gas, liquid and in the solid state as function of the relative para-ortho hydrogen concentrations. We also have in-situ dielectric spectroscopy capabilities. There is a catalysis cell and gas handling equipment that is currently being built to perform in-situ chemical reactions.

Finally, the major challenges that we are facing will be discussed, in particular methods to automate data analysis and interpretation through computer modelling. We have recently commissioned VirtuES (VIRTUal Experiments in Spectroscopy), March 2016, a computer cluster dedicated to analyse VISION data. We are developing the software to maximize the potential of the technique by generation of automated VDoS, generation of thermodynamic data, creation of databases etc.

EPSCoR DEPARTMENT of ENERGY

www.lsu.edu/physics/lacns

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