LSU College of Science

LSU Department of Physics & Astronomy

Weekly Calendar & News

March 20-25, 2017

Departmental Colloquium

Entanglement and the Foundations of Statistical Mechanics

Andreas Winter

Universidad Autònoma de Barcelona, Physics

Host: Mark Wilde and Jonathan Dowling

3:30 PM Thursday, March 23

119 Nicholson Hall

• Refreshments served at 3:10 PM in room 232 (Library) Nicholson Hall •

We consider an alternative approach to the foundations of statistical mechanics, in which subjective randomness, ensemble-averaging or time-averaging are not required. Instead, the complete physical system (i.e. the subsystem of interest together with a sufficiently large environment) is in a quantum pure state subject to a global constraint, and thermalisation results from entanglement between system and environment. In the "kinematic" setting of statistical mechanics, we formulate and prove a "General Canonical Principle", which states that the system will be thermalised for almost all pure states of the universe, and provide rigorous quantitative bounds using Levy's Lemma. We then go on to consider a full dynamical model of equilibration in a setting of closed system Hamiltonian dynamics. We find conditions under which initial states equilibrate, and under which the equi-librium state has the character of a canonical state. [Based largely on work with S Popescu and T Short, Nature Phys. 2(11):754-758, 2006; and with N Linden, S Popescu and T Short, Phys. Rev. E79:061103, 2009].

LSU Physics & Astronomy in the News

- **Minnesota professor gives lecture on science of superheroes, uses physics to explain comic book phenomena** http://www.lsunow.com/daily/minnesota-professor-gives-lecture-on-science-of-superheroes-uses-physics/article_02224aec-082c-11e7-83a8-4bb4502dbe73.html

- **TEDxLSU Sparks Chain Reaction - theadvocate.com** http://www.theadvocate.com/baton_rouge/news/communities/mid_city/article_9b95c064-0769-11e7-80cc_e3f032d4d233.html

- **For the Love of Relativity: How LIGO Scientist Amber Stuver is Realizing Her Dreams** http://lsuscienceblog.squarespace.com/blog/2017/3/13/for-the-love-of-relativity

Special Colloquium

Virgo - the Third Eye

Andrzej Królak
Institute of Mathematics Polish Academy of Sciences

Host: Param Singh

3:30 PM Tuesday, March 21

119 Nicholson Hall

I shall give a brief overview of the Virgo gravitational wave detection project. I shall present its history, achievements and current status. I shall describe its role in the in joint work with the LIGO Scientific Collaboration.

I shall overview the significance of Virgo project for the joint observations with LIGO detectors in the advanced detectors era. I shall also present the role of the Polgraw-Virgo group in the project.

I shall overview the results of the searches for gravitational waves from the rotating neutron stars in which Virgo project members played a significant role.

Hearne Eminent Lecture

Quantum Shannon Theory - On the Ultimate Physical Limits of Communication

Andreas Winter

Universidad Autònoma de Barcelona, Physics

Host: Mark Wilde and Jonathan Dowling

5:00PM Wednesday, March 22

130 Nicholson Hall

What are the ultimate limits of storing and communicating information? Since we believe that fundamentally everything is quantum, quantum mechanics gives some nontrivial answers to this question. Also, our existing communication technology is pushing us ever closer to the quantum realm. In fact, recent years have seen an explosion of ideas and results in the study of communication problems in a fully quantum mechanical setting. One of the most exciting developments in it is that the bit, the familiar and ubiquitous information unit in Claude Shannon's eponymous theory of information, now comes with exotic 'cousins' in the form of other elementary resources: the quantum bit (qubit), the entanglement unit (ebit), etc, besides what we now call the classical bit (cbit). Quantum Shannon theory thus not only aims to put a number to the ultimate communication capacity - or rather: capacities - of optical fibers and the like, but really becomes a theory of these fundamental resources and their interplay. From what we can glimpse of it, it has a rich, exciting and sometimes bewildering structure: from quantum teleportation, to unconditionally secure communication based on quantum principles, to paradoxical effects such as superactivation where two communication links, each of which cannot transmit quantum information, together can achieve this perfectly.

Events

- **Saturday Science:** Unraveling evolutionary tales hidden in genomes" by Jeremy Brown **(flyer attached below)**
  Where: Room 130 Nicholson Hall
  When: Saturday March 25, 2017 10:00 AM

- **Nano Days 2017 at Highland Road Park Observatory (flyer attached below)**
  Where: Highland Road Park Observatory
  When: Saturday March 25, 2017 2:00-6:00 PM

SATURDAY SCIENCE

Unraveling evolutionary tales hidden in genomes

A public lecture by
Dr. Jeremy Brown

About the Speaker

Dr. Jeremy M. Brown is an Assistant Professor in LSU's Dept. of Biological Sciences, and he is fascinated by the deep genealogical connections among all living things. His research compares the genomes of different organisms to understand how they are related, how they have been shaped by evolution, and how we can use this information to answer important questions.

Dr. Brown has helped to describe an unusual new species of Amazonian ant, has solved crimes by comparing HIV from different people to see how the virus was transmitted, and is trying to settle an old debate about where turtles belong in the tree of life. He will also talk about how he accidentally became a computational biologist and why he spends a lot of his time creating software and developing new statistical methods to provide better answers to questions like these.

25 March 2017, 10-11:00 a.m.

Room 130 Nicholson Hall, LSU

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NanoDays

2-6 p.m.

Saturday, March 25
Highland Road Park Observatory

The observatory will have this month's solar viewing session from 2:00-4:00 p.m. through HRPO's Coronado Solar Max II.

Lunar viewing will take place from 4:30-6:00 p.m. showing a magnified daytime waxing crescent moon.

Small Science Wields *BIG IDEAS*

NanoDays 2017

Join LSU for the 8th annual NanoDays at the Highland Road Park Observatory on Saturday, March 25, from 2-6 p.m. The free family-friendly event is open to the public and will feature several hands-on activities for guests of all ages:

- Learn first-hand how a Scanning Probe Microscope explores the nanoworld
- See how nanomaterials are used to make stain-free clothes
- Play with liquid crystals and magnets
- Make an Oobleck, a liquid with both liquid and solid properties
- At 4 p.m., get inside the mind of physicist Daniel Sheehy, a professor in the LSU Department of Physics & Astronomy, who will present "Living in the Age of Quantum Physics"

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