Astronomy Open Night, Friday, March 6, 2020
ESS 001; 7:30PM
For more information: http://www.astro.sunysb.edu/openight/opennite.html

Ricardo Herbonnet

“Observational cosmology with galaxy cluster”

In the last few decades astronomical observations have revealed the strange nature of the Universe. Observations of phenomena at vastly different ages of the Universe consistently require more than baryonic matter and baryonic physics to be explained. Both dark energy, the cause of the accelerated expansion of the Universe, and dark matter, mostly responsible for the gravitational build-up of large scale structure in the Universe, have, to date, no clear physical explanation. By putting strong limits on the energy density of these dark components with astronomical observations, theoretical models of dark matter and dark energy can be tested and refined.

A promising tool is to study the growth of structure through cosmic time. Higher density of dark matter in the Universe leads to more clustered matter distributions at the present time, whereas dark energy pulls these structures apart. Therefore, by measuring the number and mass of large objects in the Universe, we can determine the energy density of the dark components. The largest objects in the Universe are galaxy clusters and their rarity makes them a very powerful probe of cosmology. Approximately 85% of the mass of clusters is in the form of dark matter and and requires a probe of gravitating mass to be weighed. Mass estimates based on the baryonic content of the cluster are known to be biased from simulations, but gravitational lensing provides the tool to measure an unbiased total mass of dark matter and light-emitting matter. The combination of gravitational lensing with baryonic mass proxies is the key to observational galaxy cluster cosmology.

I will review how galaxy clusters are found and discuss the latest gravitational lensing measurements of galaxy clusters and their impact on cosmology.

Dr. Herbonnet obtained his Ph.D. at the University of Leiden in the Netherlands and is currently a postdoctoral researcher at Stony Brook and Brookhaven National Laboratories collaborating with Dr. Anja von der Linden.
**Physics Open Night, Friday, March 13, 2020**
ESS 001; 7:30PM

Derek Teaney

“Having fun with quark gluon plasma”

First I will describe what is the Quark-Gluon Plasma (QGP), which serves as a prototype for the types of plasmas that existed during the first microseconds after the big-bang. The QGP has several unique features: it is an ultra-relativistic plasma where radiation plays an important role and it is very non-linear (non-abelian). Finally, I will describe a sequence of experiments at Brookhaven’s Relativistic Heavy Ion Collider (RHIC) and CERN’s Large Hadron Collider (LHC) which have recreated the Quark-Gluon-Plasma in the lab (and studied its properties) by colliding large nuclei at high energies.

Derek Teaney received his undergraduate degree from Yale in 1995 and his doctoral degree from Stony Brook in 2001. After holding several posts at Brookhaven National Lab and Arkansas State University, Professor Teaney, returned to Stony Brook in 2007 as an assistant professor and was subsequently promoted to associate professor in 2013. He enjoys teaching at variety of levels.

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**Geology Open Night, Friday, March 27, 2020**
ESS 001; 7:30PM
For more information: [https://www.stonybrook.edu/commcms/geosciences/about/GeologyOpenNight](https://www.stonybrook.edu/commcms/geosciences/about/GeologyOpenNight)

Brian Phillips

“Using nuclear magnetic resonance (NMR) to locate impurities in minerals that can tell us something about their history”

Calcium carbonate minerals such as calcite are ubiquitous in nature, being the main component of limestones and similar rocks that are exposed over about 20% of Earth’s land surface. Precipitation of carbonate minerals removes CO2 from the atmosphere, while creating a repository of valuable chemical information about the environment in which they formed. During crystal growth various impurities are incorporated into the mineral, some of which geoscientists are exploiting to infer environmental conditions at the time and place the mineral precipitated, called “paleo-environmental proxies”. With micro-analytical methods now available geoscientists can read such chemical and isotopic signatures at sub-millimeter resolution to determine chemical variability at geologically short time scales. In this presentation I will discuss the factors that determine how an impurity becomes trapped in a mineral, whether its abundance is suitable for
use as an environmental proxy, and the results of some of our research that show where impurities are located in calcium carbonate minerals. For this research we use nuclear magnetic resonance (NMR) spectroscopy, which is based on the same phenomenon as MRI and measures the pitch of atomic nuclei “singing” in a strong magnetic field. This allows us to locate impurity atoms from their chemical environment and identify some of their neighbors.

Brian Phillips is a Professor in the Department of Geosciences at Stony Brook University. He has been on the faculty at Stony Brook University since 2002, where he investigates the atomic arrangement of minerals and related materials using primarily Nuclear Magnetic Resonance (NMR) spectroscopy. His research focuses particularly on bonding of atoms adsorbed to mineral surfaces and how impurities are incorporated in minerals. He is a Fellow of the Mineralogical Society of America.

**Directions to SUNY Stony Brook and ESS Building**

 dez from exit 62 of the Long Island Expressway (LIE, I-495) follow Nicolls Road (Route 97) north for nine miles. Pass the South and Main entrances to the University.
 dez Enter the North entrance which will be on your left.
 dez at the top of the small hill, turn right on Circle Road.
 dez Proceed about 1 mile.
 dez Turn left onto Campus Drive and then immediately turn left again onto John S. Toll Drive.
 dez Proceed about 50 yards then turn right into the large paved parking lot.
 dez The Earth and Space Sciences building is the large concrete building at the northeast end of the parking lot.
 Map of campus is on the web at: [http://www.stonybrook.edu/sb/map/](http://www.stonybrook.edu/sb/map/)

**TEACHER IN SERVICE CREDITS**

NYS teachers who wish to receive CTLE credit for any of these lectures must register here: [https://docs.google.com/forms/d/e/1FAIpQLSdAufjveLIIXG_-3T1ehnXOAvnAPwVMvx53NoHjyjzishlwiYA/viewform](https://docs.google.com/forms/d/e/1FAIpQLSdAufjveLIIXG_-3T1ehnXOAvnAPwVMvx53NoHjyjzishlwiYA/viewform)

You must register for each lecture you attend within one week of the lecture and sign-in at the lecture. The Graduate School will send a CTLE certificate about six weeks after each lecture.