Joint Nuclear and Astrophysics Seminar

- When: Friday February 24th at 2:00 PM
- Where: Cyclotron Institute seminar room
- Speakers: Alex Alafa and Addy Evans

TexNeut at Glance

By Alex Alafa, Cyclotron Institute, Texas A&M University.

TexNeut is a modular neutron detector composed of 128 bars of crystal scintillator *p*-Terphenyl. It was designed by graduate student Dustin Scriven, and data from its commissioning experiment (with only 42 bars) is currently being analyzed. As an undergraduate student here at TAMU, I began working on TexNeut in the summer before my 4th year and completed construction and assembly within a semester. As a graduate student, I've continued my work on the detector and began planning for TexNeut 2.0. For my talk, I will be describing how TexNeut works and what our plans are for TexNeut's future.

On the Gamma-Ray Emission From the Core of the Sagittarius Dwarf Galaxy

By Addy Evans, Physics and Astronomy Department, Texas A&M University.

One of the most elusive unknowns in particle physics and astrophysics today is the fundamental nature of dark matter. It is theoretically well-motivated that dark matter is a weakly interacting massive particle (WIMP) -- a particle lying within the GeV to TeV energy ranges that interacts very weakly with Standard Model particles. Such behavior makes dark matter extremely difficult to detect with terrestrial detectors. However, there are still many ways to probe the fundamental nature of dark matter. One such way is by searching for astrophysical signatures of dark matter annihilation. Supposing that dark matter is a WIMP which self-annihilates, we can look for inexplicable excesses of Standard Model particles from astrophysical sources. In particular, we can look for high-energy gamma-rays with energies in the range of GeV to TeV. In this talk, I will discuss recent results on the gamma-ray emission of the Sagittarius dwarf galaxy located within the Milky Way. Using data from the Large Area Telescope onboard the Fermi gamma-ray space telescope (Fermi-LAT), we investigate the faint gamma-ray source located at the center of this dwarf galaxy. In the 4FGL-DR3 catalog, this source is associated with the globular cluster, M54, which is coincident with the dynamical center of Sagittarius. We analyze the spectral energy distribution and spatial extension of this source, with the goal of testing two hypotheses: (1) the emission is due to millisecond pulsars within M54, or (2) the emission is due to annihilating dark matter from the Sagittarius halo. For the pulsar interpretation, we consider a two-component model which describes both the lower-energy magnetospheric emission and possible high-energy emission arising from inverse Compton scattering. We find that this source has a point-like morphology at low energies, consistent with magnetospheric emission, and find no evidence for a higher-energy component. For the dark matter interpretation, we find that this signal favors a dark matter mass and annihilation cross-section which is consistent with gamma-ray constraints from other dwarf galaxies and with dark matter interpretations of the Galactic Center Gamma-Ray Excess