Joint Nuclear and Astrophysics Seminar

- When: Friday September 29th at 2:00 PM
- Where: Cyclotron Institute seminar room 228
- Speakers: Emily Harris and Kaitlin Webber

Model-Independent Measurements of α-ANCs for the $^{12}C(\alpha,\gamma)^{16}O$

By Emily Harris, Cyclotron Institute, Texas A&M University.

The $^{12}C(\alpha,\gamma)^{16}O$ reaction is often considered the "Holy Grail" of nuclear astrophysics. It determines the absolute abundance of ^{12}C and ^{16}O in our universe and plays a fundamental role in the late stages of stellar evolution. However, direct measurement of this reaction is not possible with current experimental methods due to its small cross section in the Gamow energy window. Low-energy extrapolations from higher energy measurements have proven challenging for this reaction and thus the reaction rate is not known to the desired uncertainty of 10%. One way to reduce uncertainties related to low-energy extrapolations is an indirect technique that measures Asymptotic Normalization Coefficients (ANCs) of bound states extracted from sub-Coulomb α-transfer reactions. This approach provides a valuable tool for studying astrophysically important reaction rates since the results are nearly model independent. One of the remaining sources of uncertainty for extrapolation is the α-ANC of the ground state of ^{16}O. The preliminary results of an experiment performed at the Texas A&M University Cyclotron Institute using the TexPPAC detector will be presented for the sub-Coulomb α-transfer reaction of $^{12}C(^{20}Ne,^{16}O)^{16}O$.

Chemical Analysis of the Cetus II Ultra-Faint Dwarf Galaxy

By Kaitlin Webber, Physics and Astronomy Department, Texas A&M University.

Studying the chemical abundances of metal-poor stars provides insight into the early Universe and the nucleosynthesis processes of the first generation of stars. Ultra-Faint Dwarf (UFD) galaxies contain these metal poor stars and are therefore excellent candidates for abundance analysis. We present a detailed chemical abundance analysis of the brightest star in the UFD galaxy candidate Cetus II from high-resolution Magellan/MIKE spectra. For this star, DES J011740.53-173053, we derive abundances of 18 elements from Carbon to Europium. Its chemical abundances generally follow those of other UFD galaxy stars, with a slight enhancement of the alpha elements (e.g., Mg, Si, and Ca) and low neutron-capture element (e.g., Sr, Ba, Eu) abundances supporting the classification of Cetus II as a UFD. The star exhibits lower Sc, Ti, and V abundances than Milky Way (MW) halo stars with similar metallicity. This signature is consistent with yields from a supernova originating from a 11.2 solar mass progenitor. In addition, the star has a Potassium abundance of [K/Fe] = 0.81; this is somewhat higher than the [K/Fe] of MW halo stars with similar metallicity, a signature which is also present in a number of UFD galaxies. A comparison including globular clusters and stellar stream stars suggests that high [K/Fe] may be used to help classify objects as UFD galaxies.