Joint Nuclear and Astrophysics Seminar

- When: Friday December 2nd at 2:00 PM Central Time
- Where: Cyclotron Institute seminar room 228 and ZOOM: https://tamu.zoom.us/j/95700340712?pwd=dUxPbSswZG1yTlFyMC92eUdkS1RJdz09
- Speakers: Zifeng Luo and Nikko Cleri

Measurement of radiative decay branching ratio of Hoyle state in ^{12}C

By Zifeng Luo, Cyclotron Institute, Texas A&M University.

The triple-alpha process is one of the most important reactions in nuclear astrophysics. It is a sequence of two reactions a) $\alpha+\alpha \rightarrow {}^{8}Be(g.s.)$ and b) ${}^{8}Be+\alpha \Leftrightarrow \gamma+{}^{12}C$ leading to the production of carbon. The second reaction proceeds through a special excited 0^+ state at 7.65 MeV excitation energy in ^{12}C, the so-called Hoyle state. The reaction rate of the triple-alpha process is proportional to $\Gamma_\alpha\Gamma_{rad}/(\Gamma_\alpha+\Gamma_{rad}) \approx \Gamma_{rad}$ since $\Gamma_\alpha \gg \Gamma_{rad}$. One way to establish the Γ_{rad} is to measure the branching ratio for electromagnetic decay and utilize the known partial width Γ_π (E0) for the electron-positron pair production. A recent measurement of the branching ratio for electromagnetic decay is more than 3σ away from the adopted value. Our work is to verify the result by measuring the total radiative decay branching ratio of the Hoyle state in ^{12}C. The Hoyle state in ^{12}C was populated through $^{12}C(\alpha, \alpha')\,^{12}C'$ inelastic scattering. The scattered α-particles were detected by a ΔE-E telescope, and the heavy ^{12}C recoils were detected by the newly developed MDM-TexPPAC system. TOF technology and track reconstruction are used to identify the decay products of ^{12}C (7.65). The data analysis is still ongoing.

Using [Ne V] to Constrain the Sources of Highly-Energetic Photoionization Across Cosmic Time

By Nikko Cleri, Texas A&M University

Quaduply-ionized neon ([Ne V]) emission probes extremely energetic photoionization (creation potential of 97.11 eV), and is often attributed to energetic radiation from active galactic nuclei (AGN), radiative supernova shocks, or an otherwise very hard ionizing spectrum from the stellar continuum. In this work, we use [Ne V] in conjunction with other rest-frame UV/optical emission lines (from HST) and X-ray luminosities (from Spitzer) to place constraints on the nature of the ionizing engine. We present 25 [Ne V] emitting galaxies near the peak of cosmic star formation ($z\sim2$), and find that a majority of these galaxies have properties consistent with ionization from AGN. However, for our [Ne V]-selected sample, the X-ray luminosities are consistent with local ($z < 0.1$) X-ray-selected Seyferts, but the [Ne V] luminosities are more consistent with those from $z \sim 1$ X-ray-selected QSOs. The excess [Ne V] emission requires either reduced hard X-rays, or a ~0.1 keV excess. We discuss possible origins of the apparent [Ne V] excess, and present photoionization models to constrain the underlying physics. We also consider implications for future studies of extreme high-ionization systems in the epoch of reionization ($z > 6$) with the James Webb Space Telescope.