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Probing the Astrophysical Sites of Light and Heavy Elements

Wednesday, 8 February 2017 14:45 (15 minutes)

Galactic chemical evolution (GCE) is a multidisciplinary topic that involves nuclear physics, stellar evolution, galaxy evolution, and cosmology. Observations, experiments, and theories need to work together in order to build a comprehensive understanding of how the chemical elements synthesized in astronomical events are spread inside and around galaxies and recycled into new generations of stars. I will present our GCE pipeline developed within the JINA-CEE and NuGrid collaborations and demonstrate its capability to create interdisciplinary connections, to probe the impact of nuclear astrophysics in a GCE context, and to constrain the astrophysical sites of light and heavy elements. I will first address the role of neutron star mergers (NSMs) in the evolution of r-process elements in the Milky Way. The NSM rates required in GCE studies and predicted by population synthesis models are only marginally consistent with each other, but are both below the current upper limits established by Advanced LIGO. Upcoming gravitational wave measurements will determine whether or not the GCE requirement is realistic. I will then show that the production of odd-Z elements in O-C shell mergers in massive stars (new discovery, C. Ritter et al.) can solve the long-lasting underproduction of Cl, K, and Sc in GCE models. Finally, I will discuss the role of rapidly accreting white dwarfs (iRAWDs) in the evolution of i-process elements in a GCE context.

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