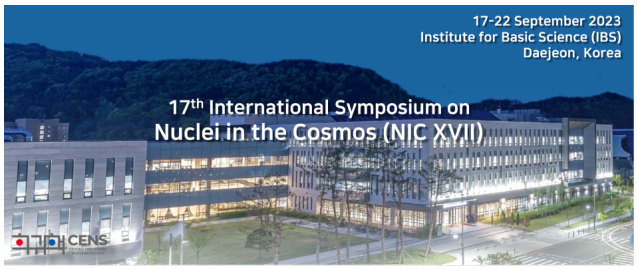

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Understanding the S- and C-type Giant Stars in the Milky Way

Tuesday, 19 September 2023 17:15 (5 minutes)

Asymptotic giant branch (AGB) stars are a key site of element synthesis in galaxies. As low-mass AGB stars evolve, they undergo internal helium-burning shell flashes, or thermal pulses. These thermal pulses temporarily extinguish the hydrogen-burning shell, allowing the convective envelope of the star to move into the intershell region, mixing products of helium-burning to the surface, including carbon. This is known as third dredge-up (TDU). The envelopes of the majority of AGB stars are oxygen-rich, and are classified as M-type. After enough mixing episodes, the star may eventually become "carbon-rich", meaning the surface carbon-to-oxygen ratio (C/O) exceeds unity. These stars also show signs of s-process element enhancement, such as technetium. Generally, it is thought that the carbon enrichment follows a sequence from M-type to C-type (carbon-rich), moving through S-type (C/O = 0.5-0.99) before becoming C-type (C/O > 1). These intermediate S-type stars are of particular interest because they have likely only recently commenced episodes of TDU. A significant uncertainty in stellar modelling is the minimum stellar mass for TDU, as well as its efficiency as a function of stellar mass; therefore, accurately determining the masses of these S-stars can help us address these uncertainties.
The third data release of the Gaia survey has improved the luminosity determination of S-stars. However, constraining their current and initial masses remains complicated and requires stellar modelling, as AGB stars show long-period variability from radial pulsations, as well as longer term variability from thermal pulses. In this poster, we use radial pulsations to improve upon stellar mass estimates for Galactic S-stars. These will allow us to better constrain the minimum mass required for TDU in stellar models, and ultimately address uncertainties in the stellar yields of AGB stars and the chemical enrichment of the Milky Way galaxy.

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