Former JINA post-doctoral fellow, JINA scientists, and an international team of astronomers have recently developed a new method for the determination of stellar [C/Fe] abundance ratios, using medium-resolution stellar spectra from the Sloan Digital Sky Survey (SDSS) and its Galactic sub-survey, the Sloan Extension for Galactic Understanding and Exploration (SEGUE).

Based on the measured carbon-to-iron abundance ratios obtained by this technique, they derive the frequency of carbon-enhanced stars ([C/Fe] ≥ +0.7) as a function of [Fe/H], for both the SDSS/SEGUE stars and other samples from the literature. They report that the differential frequency of these C-rich stars slowly rises from almost zero to about 14% at [Fe/H] ~ −2.4, followed by a sudden increase, by about a factor of three, to 39% from [Fe/H] ~ −2.4 to [Fe/H] ~ −3.7. Although the number of stars known with [Fe/H] < −4.0 remains small, the frequency of carbon-enhanced metal-poor (CEMP) stars below this value is around 75%.

They also examine how the cumulative frequency of CEMP stars varies across different luminosity classes. The giant sample exhibits a cumulative CEMP frequency of 32% for [Fe/H] ≤ −2.5, 31% for [Fe/H] ≤ −3.0, and 33% for [Fe/H] ≤ −3.5; a roughly constant value. For the main-sequence turnoff stars, they obtain a lower cumulative CEMP frequency, around 10% for [Fe/H] ≤ −2.5, presumably due to the difficulty of identifying CEMP stars among warmer turnoff stars. The dwarf population displays a large change in the cumulative frequency for CEMP stars below [Fe/H] = −2.5, jumping from 15% for [Fe/H] ≤ −2.5 to about 75% for [Fe/H] ≤ −3.0. The general rise in the global CEMP frequency at low metallicity is likely due to the transition from the inner-halo to the outer-halo stellar populations with declining metallicity and increasing distance from the plane.

Contact: Young Sun Lee (NMSU; yslee@nmsu.edu)

Researchers: Y.S. Lee (NMSU), T.C. Beers (NOAO), T. Masseron (IAA, Belgium), B. Plez (Univ. Montpellier), C.M. Rockosi (UCSC), J. Sobeck (Univ. Virginia), B. Yanny (FNAL), S. Lucatello (INAF, Italy), T. Sivarani (IIAP, India), V.M. Placco (Gemini Obs.), D. Carollo (Macquarie Univ., Australia)

Publications: Lee et al. (2013), Astronomical Journal, 146, 132