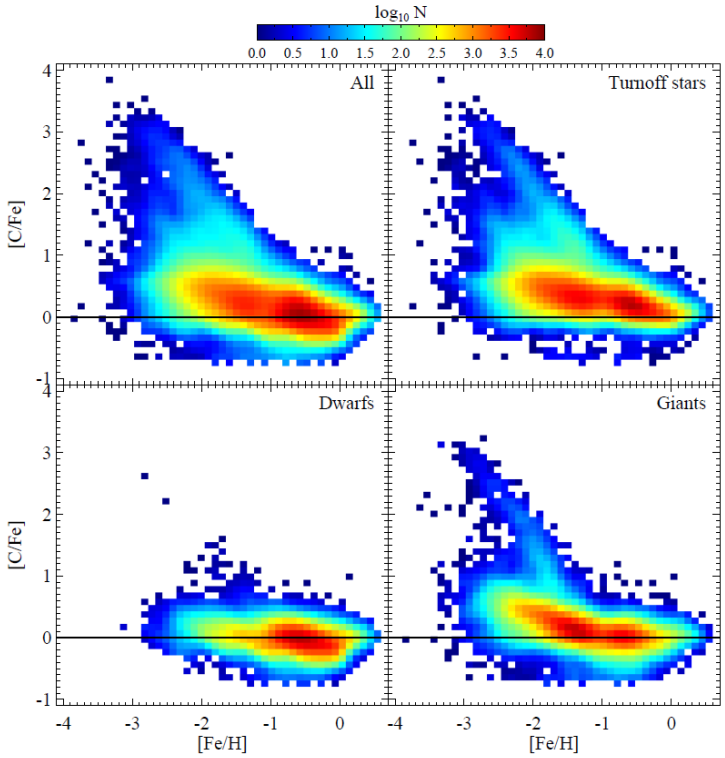
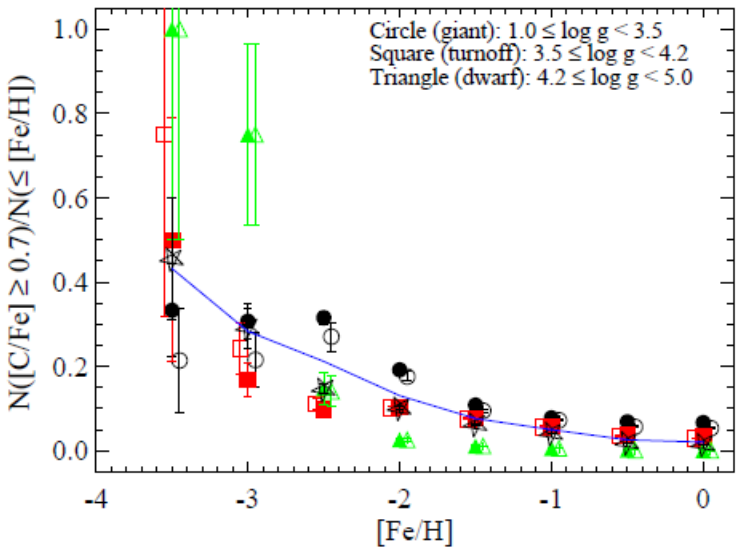
Carbon-Enhanced Metal-Poor Stars in SDSS/SEGUE



Number–density distribution of the SDSS/SEGUE sample in the [C/Fe] and [Fe/H] plane for the entire sample (top-left), the turnoff stars (top-right , dwarfs (bottom-left), and giants (bottom-right). The solid horizontal lines are the solar value of [C/Fe]. The color bar at the top shows the number of stars per 0.1 × 0.1 dex bin.



Cumulative frequencies of CEMP stars ([C/Fe] ≥ +0.7) from the SDSS/SEGUE sample, as a function of [Fe/H], for three different luminosity classes: giants (circles), main-sequence turnoff stars (squares), and dwarfs (triangles). Poisson error bars are plotted.

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.

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