COLLOQUIUM

Carbon in the Early Universe and Observational Constraints on First-Star Nucleosynthesis

Timothy C. Beers

University of Notre Dame

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Over the past 25 years, it has been recognized that the light element carbon plays a crucial role in the early chemical enrichment of the Universe. One fundamental observation is that the frequency of the so-called carbon-enhanced metal-poor (CEMP) stars in the Milky Way increases dramatically with decreasing iron abundance – from 20% of all stars with [Fe/H] < -2.0 to > 80% of stars with [Fe/H] < -4.0. Recent discoveries of enhanced carbon in damped Lyman alpha systems at high redshift reveal that the abundance patterns observed in this gas are commensurate with a sub-class of the CEMP stars, the so-called CEMP-no stars, which exhibit little or no enhancement of their neutron-capture elements – providing one of the first direct observational linkages between the high-z Universe and presently observed stars in the Galaxy. I summarize recent progress on our understanding of the production of carbon by first-generation stars, and the powerful constraints that this information provides on Galactic chemical evolution models, the initial mass function in the early Universe, and the nature of first-star nucleosynthesis.