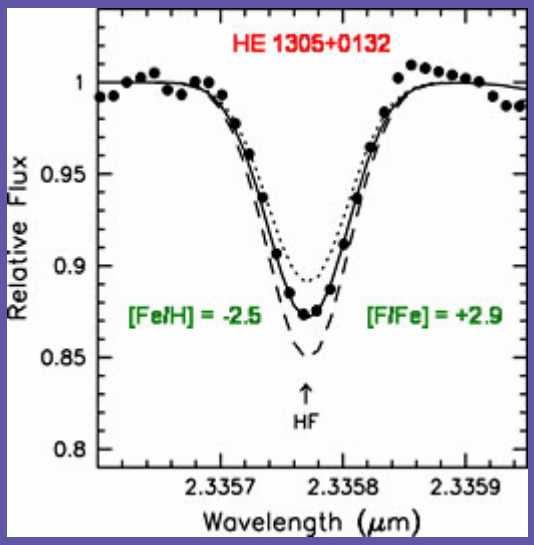
First Measurement of Fluorine in Carbon-Enhanced Metal-Poor Stars



The line of the molecular species HF, observed at high spectral resolution in the near-IR with the Gemini South 8m telescope. The dots indicate the data while the solid line indicates the best synthesis of the feature, from which the F abundance has been extracted. Additional CEMP Stars are being observed at present, so that a statistical sample of F measurements can be obtained.

In collaboration with JINA co-PI Beers, and JINA-supported postdoctoral fellow Sivarani and graduate student Lee, Schuler et al. (2007) have reported the first measurement of the light element Fluorine (F) in a very metal-poor carbon-enhanced (CEMP) star.

The star in which F was measured, HE 1305+0132, has a metal abundance [Fe/H] = −2.5. Stars significantly deficient in metals relative to the Sun are presumed to be remnants of the earliest stellar populations and represent the oldest stars in the Galaxy. It is estimated that 14 - 25% of metal-poor stars with metallicities of [Fe/H] < −2.0 are enhanced in carbon ([C/Fe] > +1.0), and studies suggest that the percentage of these CEMP stars increases with decreasing metallicity, reaching 40% of stars with [Fe/H] < − 3.5 and 100% of stars with [Fe/H] < − 4.0. Thus, determining the origin of the carbon and other metals in CEMP stars is clearly important to our understanding of the chemical evolution of the early Galaxy.

Asymptotic Giant Branch (AGB) stars and massive, rapidly-rotating metal-poor stars are the predicted sources of the enhanced carbon in CEMP stars. Using spectral synthesis we derive for HE 1305+0132 a super-solar 19F abundance, corresponding to a relative abundance of [F/Fe] = +2.90. This result suggests that the atmosphere of HE 1305+0132 has been polluted via mass transfer by a companion AGB star and that AGB star nucleosynthesis can be highly efficient at low metallicities.

Reference:

Schuler, S.C., Cunha, K., Smith, V.V., Sivarani, T., Beers, T.C., & Lee, Y.S. (2007), ApJ 667, L81