Contribution ID: **25** Type: **not specified**

Oxygen-enhanced extremely metal-poor DLAs: A signpost of the first stars?

Thursday 21 October 2021 12:05 (15 minutes)

The properties of the first stars remain unknown. The chemistry of relic environments, enriched only by the supernovae of the first (Pop III) stars, may offer the best opportunity to uncover their properties (e.g. mass distribution and explosion energies). In this talk, I will present the analysis of two of the most chemically near-pristine gas reservoirs at a redshift z~3 observed using a high resolution spectrograph (R~40,000). The primary aim is to assess the nature of the [O/Fe] ratio in the extremely metal-poor (i.e. <1/1000 of the solar metallicity) regime. Prior observations indicate that the [O/Fe] ratio of metal-poor ([Fe/H]<-2) DLAs is consistent with a constant value, [O/Fe]~+0.4, but this ratio may increase when [Fe/H] < -3. I report [O/Fe] =+0.51 +/- 0.10 and [O/Fe]=+0.62 +/- 0.05 for two near-pristine gas reservoirs. These new, high-precision measurements strengthen the idea that the [O/Fe] abundances of the most metal-poor DLAs are elevated compared to DLAs with [Fe/H]>-3. This elevated [O/Fe] ratio may be a sign of enrichment from a generation of metal-free stars. I compare the observed abundance pattern of the latter system to the nucleosynthetic yields of Pop III supernovae using a stochastic chemical enrichment model. Future high-precision measurements in new systems will contribute to a firm detection of the relationship between [O/Fe] and [Fe/H], and allow us to rule out potential contamination from Pop II stars. This effort will be aided with the advent of the WEAVE survey. I suggest that the combined study of near-pristine gas reservoirs along with stars in halo of the Milky Way and surrounding dwarf galaxies may draw out evolutionary relationships and help reveal the properties of the first stars.

Type

contributed talk

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Session Classification: Day 4