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New avenues to indirectly study the nature of the first stars

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The first stars were born from chemically pristine gas. They were likely massive and thus they rapidly exploded as supernovae, enriching the surrounding gas with heavy elements.
The nature of first stars can be studied locally, investigating the chemical properties of ancient metal-poor stars in the Milky Way halo and in Local Group dwarf galaxies. Indeed, here we observe low-mass, long-lived stars that provide an opportunity to explore the chemical and physical conditions of the earliest star-forming environments in the Universe in terms of first stars signatures. Complementarily to this approach, the investigation of high-redshift gaseous environments and their metal content, through direct observations against bright background sources, is a valuable diagnostic, which would help to catch first stars signatures.

In this talk I will report new results on this last approach. In particular I will show a recent work (A. Saccardi, S. Salvadori, V. D'Odorico et al. in press) on the signatures of first stars in high-redshift absorbers. Through the analysis of the spectra of QSO lines of sight, we detected 3 very metal-poor, carbon-enhanced systems, at redshift z~3-4. These absorption systems reveal an overabundance with respect to Fe of all the analyzed chemical elements such as C, O, Mg, Al, and Si. The distribution of the relative abundances with respect to [Fe/H] perfectly matches those of the local very metal-poor stars. Consequently, these absorbers, likely imprinted by the chemical yields of the first stars, suggest that the signature of the first stars survives in optically thick, relatively diffuse absorbers, not sufficiently dense to sustain star formation and hence, not dominated by the chemical products of normal stars.

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