Modeling the Pristine Gas & Pop III Star Formation in the Early Universe

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ABSTRACT: Finding and characterizing the first galaxies is the next frontier in observational astronomy. Of course, the first galaxies were populated with the first, metal free stars: the Population III (Pop III) stars. In this talk I will describe a new theoretical model embedded in a cosmological simulation that I have used to follow and understand Pop III star formation and the transition to Population II (Pop II) star formation. Characterizing this transition will aid in the search for Pop III stars and help us understand the unusual elemental abundances we see in some of the oldest stellar systems studied by observers. By tying observed stellar abundances to elemental yields from the first supernova (SN), we can infer some of the characteristics of this first generations of stars. In particular, Carbon-Enhanced Metal-Poor (CEMP) stars, found in the Milky Way halo, as well as some of the ancient stars found in ultra-faint dwarf (UFD) galaxies are thought to have captured the chemical imprint of Pop III SN and neutron star mergers (NSM). While this effort can only hint at the Pop III IMF, it can be used to rule out certain progenitor models without the need to run computationally costly chemical network modeling within cosmological codes.