Contribution ID: **22** Type: **Poster**

Where do Population III Stars Form? The Effects of Radiative Feedback and Self-Shielding on the Host Halo Mass Distribution

Tuesday, 4 December 2018 16:28 (1 minute)

We perform a cosmological simulation with a comoving volume of 1 Mpc^3 to study the birthplaces of Population III stars, using the adaptive mesh refinement code Enzo. We investigate the distribution of host halo masses and its relationship to the Lyman-Werner background intensity. In our sample of 697 host halos, we find that 84% of them have masses below the Machecek et al. (2001) relation because of the inclusion of H2 self-shielding. In our simulation above a redshift of 12.5, the mean halo mass is time-independent and ~$10^{5.8}$ solar masses. Afterwards, it steadily rises above the Machacek et al. relation to a mean value of ~$10^{6.6}$ solar masses. Most of these halos form multiple Population III stars, with a median number of four, up to a maximum of 16. We also find that a few halos do form stars below the Machacek et al. relation but in a high Lyman-Werner radiation field with values up to ~50 J_{21}. Our results suggest that Population III star formation may be less affected by Lyman-Werner radiation feedback than previously thought and that Population III multiple systems are common

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Talk/Poster

Poster

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Session Classification: Poster Short Presentations