Early Impacts of the First Stars

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We use the three-dimensional smoothed particle hydrodynamics code GADGET-2 [1], with detailed cooling and chemistry of primordial gas, and a radiative transfer scheme of ray-tracing, to study the realistic radiative feedback of first stars to the surrounding primordial gas. Based on previous work, together with detailed stellar evolution models by the MESA code provided [2], time-dependent properties of first single and binary stars are captured and implemented in simulations. The simulations start from a minihalo (z 28) with the mass resolution about a few solar masses to the end of the lifetime in each stellar system. We present some preliminary results including single and binary stars with/without interaction and binary cases with a disk. Also, we discuss essential feedbacks of first stars and possibilities of future works, such as gamma-ray bursts, X-ray binaries, and supernovae, extending to the formation of the 2^{nd} generation of stars and first galaxies.

[1] V. Springel, "GADGET-2: A Code for Cosmological Simulations of Structure Formation," Astrophysics Source Code Library, Mar. 2000.

[2] B. Paxton, L. Bildsten, A. Dotter, F. H. S. Code, and 2010, "MESA: Modules for Experiments in Stellar Astrophysics," adsabs.harvard.edu.