X63a Impact of Star Formation and Stellar Feedback on First Galaxies and beyond

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We present the results on the formation of first galaxies at $z \geq 6$ using cosmological hydrodynamic simulations with zoom-in initial conditions. We focus on three different halos with masses $M_h \sim 10^{10} - 10^{12} h^{-1} M_\odot$ at z = 6. Our simulations probe the impact of different subgrid models of star formation (SF) and supernova (SN) feedback. We find that SF occurs intermittently due to SN feedback at $z \geq 10$, and then it proceeds more smoothly as the halo mass grows at lower redshifts. Galactic disks are destroyed due to SN feedback, while galaxies in simulations with no-feedback or a lower SF efficiency can sustain a galactic disk for longer periods. The expulsion of gas by SN feedback makes the inner density profile of dark matter shallower, but not for a long period of time. Our simulated galaxies reproduce the observed star formation rates and stellar masses of observed Lyman-α emitters at $z \sim 7 - 8$ fairly well.

We also present some test results of new GADGET3-Osaka feedback model, which utilizes the Sedov-Taylor solution for the SN feedback bubble expansion and its lifetime. We verify the model with isolated galaxy model, and find that a reasonable outflow is generated from self-regulated star formation in the disk. We also show that our new Osaka-feedback model produces more favorable results on galaxy stellar mass function and stellar-to-halo-mass ratio in a cosmological volume of comoving $(40\,h^{-1}\mathrm{Mpc})^3$ compared to previous models. These new simulations will be useful in making various predictions for the upcoming Subaru PFS observations.