# A new semi-analytic model of Pop III formation with ultralarge cosmological $N$-body simulations

T. Ishiyama[1], and S. Hirano[2]

[1]Institute of Management and Information Technologies, Chiba University, Chiba 263-8522, Japan
[2]Department of Earth and Planetary Sciences, Kyushu University, Fukuoka 819-0395, Japan

Based on the previous work [1], we are developing a new semi-analytic model of the formation of Population III (Pop III) stars on dark halo/subhalo merger trees constructed using a series of large cosmological $N$-body simulations. The largest simulation consists of $4096^3$ particles in $(16\,\mathrm{Mpc}\,h^{-1})^3$ volume from redshift $z = 127$ to 0 with resolving the minimum halo mass (about $10^5\,\mathrm{M}_\odot\,h^{-1}$) by 20 $N$-body particles, which is enough to resolve Pop III forming minihalos. Then we generate the merger trees using Rockstar phase space halo/subhalo finder [2] and consistent trees merger tree code [3] for the full volume from $z = 31$ to 10, and for dozens of Milk Way-like halos from $z = 31$ to $z = 0$.

We report how the difference of the condition for the Pop III formation (e.g., minihalo mass threshold, and the treatment of the Lyman-Werner feedback) impact the number and spatial distribution of Pop III forming minihalos at high-redshift, and the observability of low-mass Pop III survivors in the Milk Way-like halos at $z = 0$.

[1] T. Ishiyama, K. Sudo, S. Yokoi, K. Hasegawa, N. Tominaga, and H. Susa (2016), ApJ, 826 (9)

[2] P. S. Behroozi, R. H. Wechsler, and H. -Y. Wu (2013), ApJ, 762 (109)

[3] P. S. Behroozi, R. H. Wechsler, H. -Y. Wu, M. T. Busha, A. A. Klypin, and J. R. Primack (2013), ApJ, 763 (18)