"Constraining the Nature of the First Stars with Galactic Archaeology"

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利用カテゴリ　　XC-Trial

MOTIVATION

We want to constrain the mass distribution of the first stars in the Universe by combining state-of-the-art computer simulations with the latest spectroscopic observations of second generation stars in our Galaxy.

The results will have two direct impacts: they allow us to optimise future stellar archaeology surveys to find more precious second generation stars that we might otherwise miss based on current selection criteria. Second, the derived first mass function serves as initial conditions for theoretical models of galaxy formation and to correctly interpret upcoming observations.

PROGRESS

In the academic year 2017 I have used the machine Cray XC 30 with an XC-Trial account. I arrived at the University of Tokyo end of October 2017 and started using the CFCA resources in January 2018. We run the simulations with a customised version of the moving-mesh code Arepo (Springel, 2010) and first results are illustrated in Fig. 1.
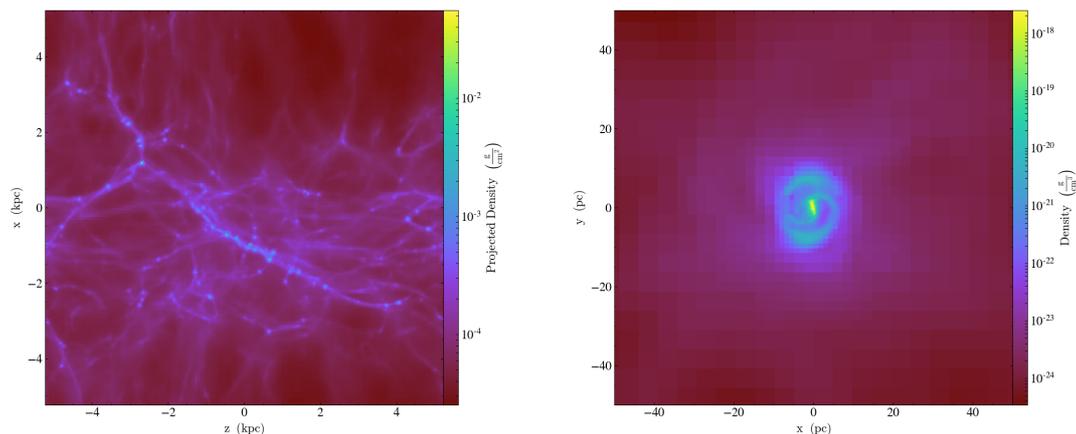

Figure 1: Left: projection of the gas distribution at redshift z=12. The filamentary structure of the cosmic web can clearly be seen. Right: zoom on one of the first galaxy cores during run-away collapse.

To efficiently use the computational resources we perform zoom-in simulations with a user-defined refinement criterion. We have tested different implementations and have compared their performance. In Fig. 2 we show the cell mass distribution for a refinement criterion that guarantees that the local Jeans length is resolved by at least 4 cells.

OUTLOOK

In the 2 month of effective use of XC30 we were able to perform several tests on the resolution, parallelisation scalability, and refinement criteria, but we were not able to start the science runs for this project. Therefore, there are currently no related publications to report.

With the upgraded XC50 machine we expect to run the simulations this summer and analyse them until end of this year.
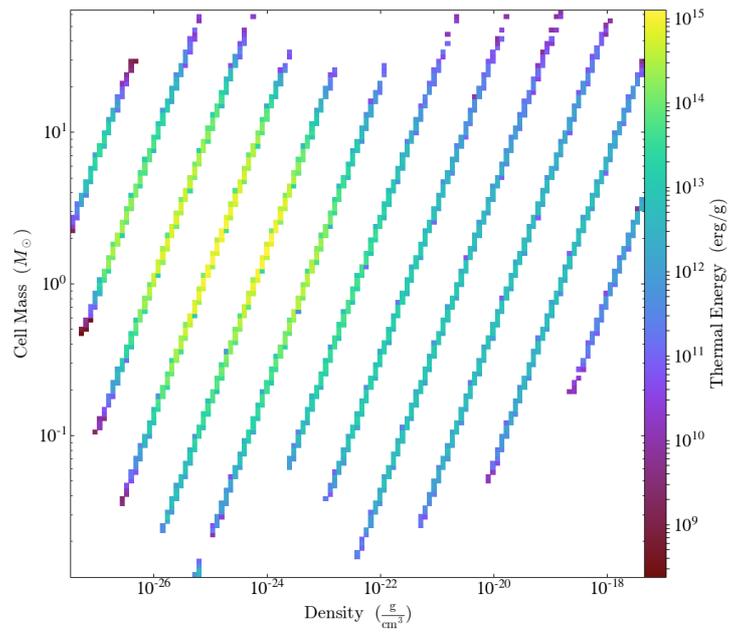
Figure 2: *Cell mass as a function of the gas density color coded by the thermal energy as a proxy for the temperature.*