
Galaxy Identification with the 6D Friends-of-friend Algorithm on the NewHorizon Simulation and its Comparison to the GALAXYMaker Data

Jinsu Rhee^{*1}, Sukyoung, K. Yi², and Pascal Elahi³

¹Yonsei University – South Korea

²Yonsei University – South Korea

³University of Western Australia – Australia

Abstract

Galaxy/Halo finding based on the friends-of-friend (FoF) algorithm has been widely adopted for its simplicity and expandability to the phase-space.

However, cosmological simulations have been progressively bigger in size and more accurate in resolutions, resulting in that galaxy/halo finding gets computationally expensive more and more.

In fact, we confirm this issue through our exercise of applying the 6-dimensional (6D) FoF galaxy finder code, VELOCiraptor (Elahi et al.2019) on the NewHorizon simulation (Dubois et al. 2021), in which typical galaxies with $M_{\text{sun}} \sim 1e11$ (10^7 particles) are identified with very low speed (longer than a day).

We have applied several improvements to the original VELOCiraptor code that solve the low-performance problem of galaxy finding on a simulation with high resolutions.

Our modifications find the exact same FoF group and can be readily applied to any tree-based FoF code, achieving a 2700 (12) times speedup in the 3D (6D) FoF search compared to the original execution.

We applied the updated version of VELOCiraptor on the entire NewHorizon simulation (834 snapshots) and identified its galaxies and halos, hoping to provide the whole catalogue to the community.

We present several quick comparisons of galaxy properties with those with GALAXYMaker data.

*Speaker