[구CD-11] Halo interactions in the Horizon run 4 simulation

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Interactions such as mergers and flybys play a fundamental role in shaping galaxy morphology. We used the Horizon Run 4 cosmological N-body simulations to study the frequency and the type of halo interactions as a function of the environment, the separation p, the mass ratio q, and the target halo mass. We defined targets as haloes more massive than 10^11 Msun/h, and a target is interacting if it is located within the virial radius of a neighbour halo more massive than 0.4 times the target mass.

We find that the interaction rate as a function of time has a universal shape for different halo mass and large-scale density, with an increase and saturation. Larger density yield steeper slopes and larger final interaction rates, while larger masses saturate later. Most interactions happen at large-scale density contrast δ about 10^3 , regardless of the redshift. We also report the existence of two modes of interactions in the (p,q) plane, reflecting the nature (satellite or main halo) of the target halo. These two trends strongly evolve with redshift, target mass, and large-scale density.

Interacting pairs have similar spins parameters and aligned spins, with radial trajectories, and prograde encounters for non-radial trajectories. The satellite trajectories become less and less radial as time proceed. This effect is stronger for higher-mass target, but independent of the large-scale density.