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The dark matter assembly of the Local Group in constrained cosmological simulations of a LambdaCDM universe

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We make detailed theoretical predictions for the assembly properties of the Local Group (LG) in the standard LambdaCDM cosmological model. We use three cosmological N-body dark matter simulations from the CLUES project, which are designed to reproduce the main dynamical features of the matter distribution down to the scale of a few Mpc around the LG. Additionally, we use the results of an unconstrained simulation with a sixty times larger volume to calibrate the influence of cosmic variance. We characterize the Mass Aggregation History (MAH) for each halo by three characteristic times, the formation, assembly and last major merger times. A major merger is defined by a minimal mass ratio of 10:1. We find that the three LGs share a similar MAH with formation and last major merger epochs placed on average \approx 10 - 12 Gyr ago. Between 12% and 17% of the halos in the mass range 5 x 10^11 Msol/h < M_h < 5 x 10^12 Msol/h have a similar MAH. In a set of pairs of halos within the same mass range, a fraction of 1% to 3% share similar formation properties as both halos in the simulated LG. An unsolved question posed by our results is the dynamical origin of the MAH of the LGs. The isolation criteria commonly used to define LG-like halos in unconstrained simulations do not narrow down the halo population into a set with quiet MAHs, nor does a further constraint to reside in a low density environment. The quiet MAH of the LGs provides a favorable environment for the formation of disk galaxies like the Milky Way and M31. The timing for the beginning of the last major merger in the Milky Way dark matter halo matches with the gas rich merger origin for the thick component in the galactic disk. Our results support the view that the specific large and mid scale environment around the Local Group play a critical role in shaping its MAH and hence its baryonic structure at present.

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