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THE LOCAL GROUP IN AN EXPLICIT COSMOLOGICAL CONTEXT

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We present recent results on the effort to simulate the Local Group (LG, composed by the Milky Way and M31) in an explicit cosmological context. The main results are obtained using cosmological N-body simulations that use constrained initial conditions aiming at reproducing the observed large scale environment. We find that in these simulations there is a bias in the formation properties of the LG with respect to a random sample. We also show that the observed radial motion of Andromeda towards us is not common in the context provided by ΛCDM.

Using constrained simulations built within the CLUES (Constrained Local UniversE Simulations) project (Yepes et al. 2013) we found (Forero-Romero et al. 2009) that the Local Group (LG) pairs in these simulations share similar, relatively quiet, mass aggregation histories (MAHs) with formation times and last major merger epochs located on average $\approx 10-12$ Gyr ago. In a set of pairs of haloes within the same mass range only a fraction of $1-3$ per cent share similar formation properties.

We also studied the LG kinematics in a cosmological context. We used public data (Riebe et al. 2013) from a large unconstrained simulation dubbed Bolshoi (Klypin et al. 2011). We found (Forero-Romero et al. 2012) that the most probable values for the tangential and radial velocities in halo pairs are $v_{\rm rad,\Lambda CDM} = -60\pm15$ km s^{-1} and $v_{\rm tan,\Lambda CDM} = 50\pm5$ km s^{-1}. Within a similar absolute uncertainty defined by observations the pairs centered around these values are ~ 3 times more abundant than the pairs in the observational interval, which is consistent with a head on collision (van der Marel et al. 2012). Furthermore, we found that only $\sim$ 12% of the pairs show a ratio between its tangential and radial velocity consistent with observations. These results suggest that the formation and evolution of the LG differ from the average ΛCDM halo pair.

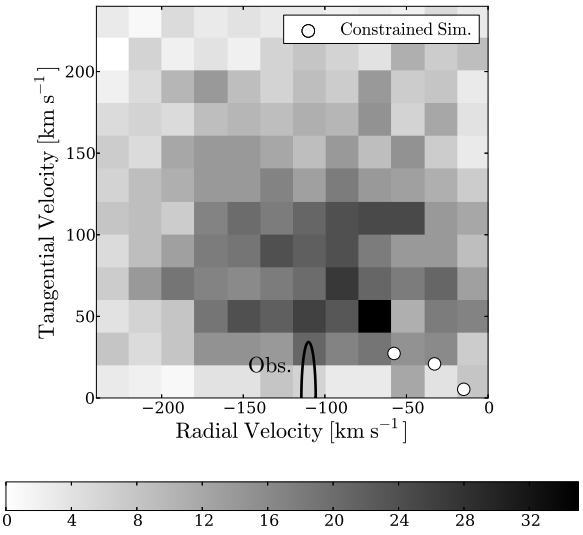

Fig. 1. 2D histograms for LG-like halo pairs in the Bolshoi simulation. The axis indicate the radial and tangential velocities of halo pairs in the. The half-ellipsoid marks the observational constraints and the white dots the results from three constrained simulations. Figure reproduced from Forero-Romero et al. 2013.

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