PAIRS, GROUPS AND FILAMENTS OF DWARF GALAXIES IN THE NEARBY LYNX-CANCER VOID AS A REFLECTION OF VOID DARK MATTER DISTRIBUTION

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Abstract

The web of the three-dimensional matter distribution in the Universe is well reproduced in the N-body simulations of Dark Matter in voids, albeit scaled-down (Gottloeber et al. 2003). However, observationally, the distribution of real galaxies in voids, expected to follow the DM halos distribution, is poorly known due to lack of information on galaxies in voids in general. In the study the nearby Lynx-Cancer void, we find that dwarf galaxies populating this region form correlated stuctures - either pairs, or quasilinear filaments. The latter are suggested recently as "bridges" (Park & Lee 2009), along which the baryon matter can inflow into galaxies formed in a filament and feed their "activity". Voids are a suitable environment to check this mechanism. We present the list of Lynx-Cancer void pairs and probable filaments and some of their relevant parameters, and discuss the potential of Lynx-Cancer void in studies properties of 'low-mass' filaments.

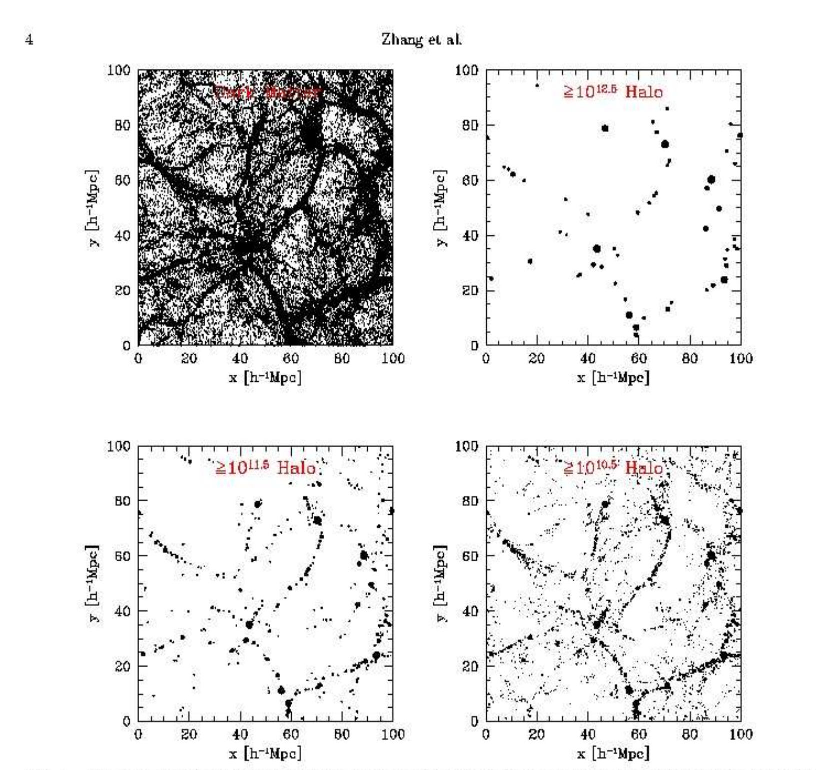

Fig. 1: Illustration of DM halo distribution in a slice of 6 Mpc thickness of cube with a side of 140 Mpc, from the simulation of 10^9 DM particles with $M_{part}=10^8$ Mo and minimal bound DM halo mass of 5×10^{10} Mo (Zhang et al. 2009, arXiv:0906.1654). Filaments are the most striking features.

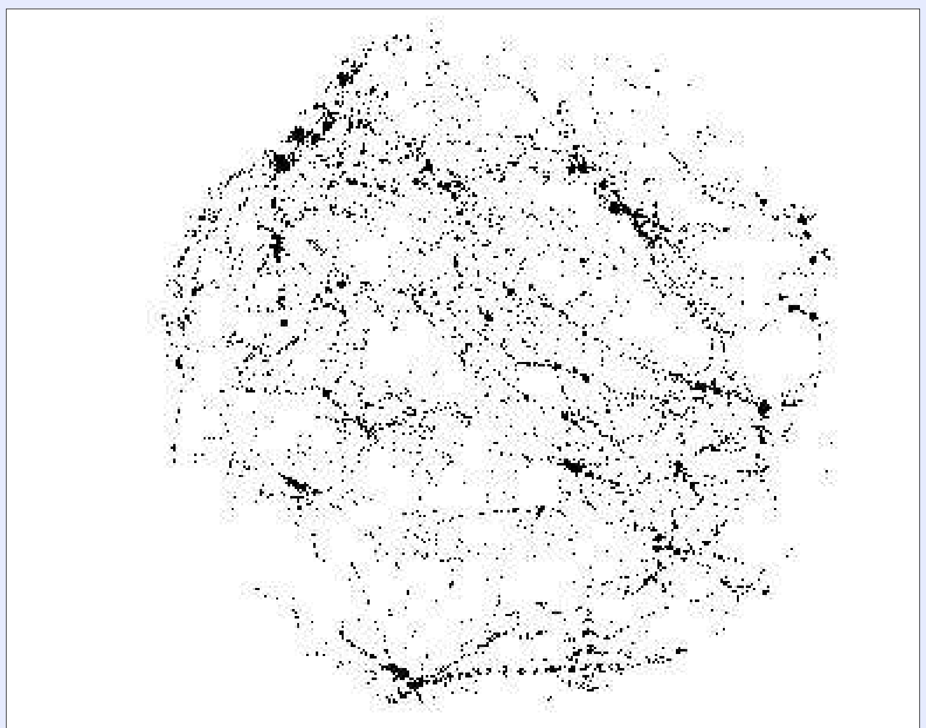

Fig. 2: Illustration of DM halo distribution in a void with diameter of 30 Mpc, from the simulation of 10^9 DM particles with $M_{part}=6\times10^7$ Mo and minimal bound DM halo mass of 1.5×10^9 Mo (Gottloeber et al., 2003, MNRAS). About 400 DM halos with circular velocities $V_{rot} > 20$ km s^{-1} are expected to fill in the void.

The nearby void in Lynx-Cancer

The Lynx-Cancer void is one of the nearest known (D_{center} ~14 Mpc, Pustilnik et al. 2003). About 50 dwarf galaxies with absolute magnitudes M_B down to –12.5 are found to date within its borders (Pustilnik & Tepliakova 2009). Apart the study of individual properties of void galaxies, we examine their spatial distribution, aiming to define the main elements. The filaments, expected in simulations, emerge clearly. However, the substantial fraction of void galaxies appears to be isolated. The total number of the void galaxies also appears larger than expected in simulations.

Conclusions

The collected so far sample of low-mass galaxies in the nearby Lynx-Cancer void provides us with a unique opportunity to probe the structure of the DM halo distribution in voids down to masses of 10^8 $M_\odot$. Thanks to relatively quite environment, the rotation velocities of void dwarfs should be good indicators of halo virial masses. The planned extension of the void galaxy sample in expense of the expected new void LSBDs should further increase the value of the sample, especially for the quantitative confrontation of ΛCDM simulations with the real sector of "low-mass" halos.

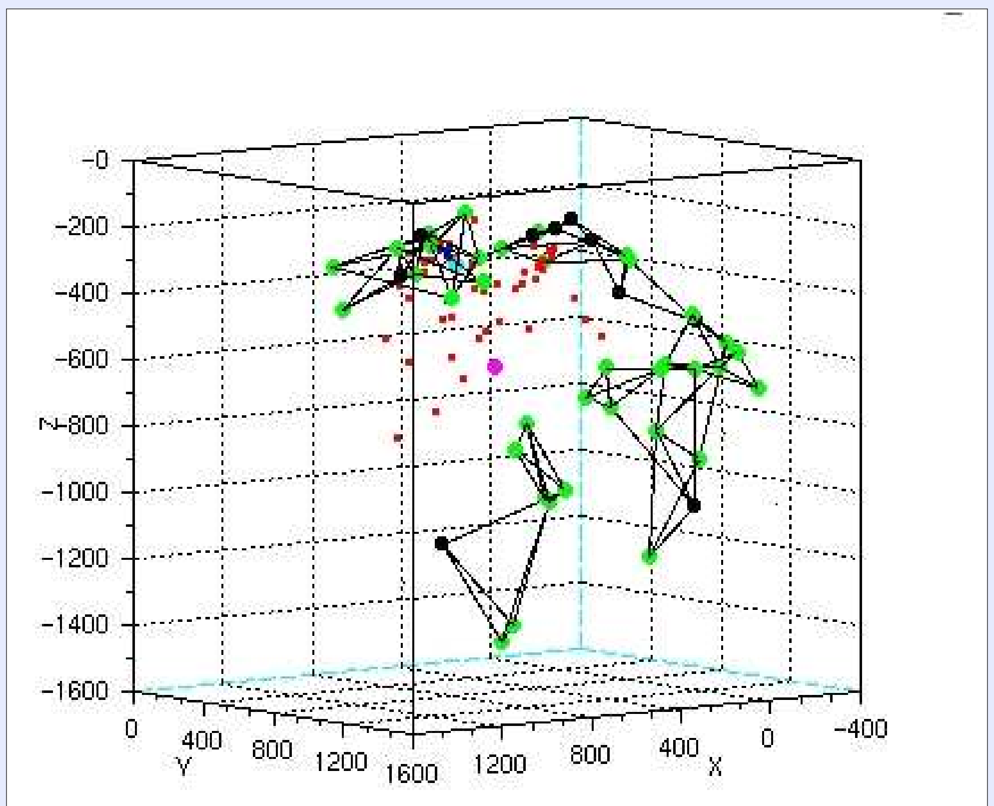

Fig. 3: The 3D view of the Lynx-Cancer void and the positions of luminous galaxies (M_B <–19.0) delineating it. The supergalactic coordinate grid (SGX, SGY, SGZ) is in units of km s^{-1}. Large filled green balls show positions of pairs and groups in which at least one 'luminous' galaxy enters. Large black filled balls show positions of 'isolated luminous' galaxies. Each luminous galaxy is joined with three the nearest neighbours to help eye to feel the void border. Dwarf galaxies populating inside the void are shown by small red squares. The large pink ball shows the conditional void center.

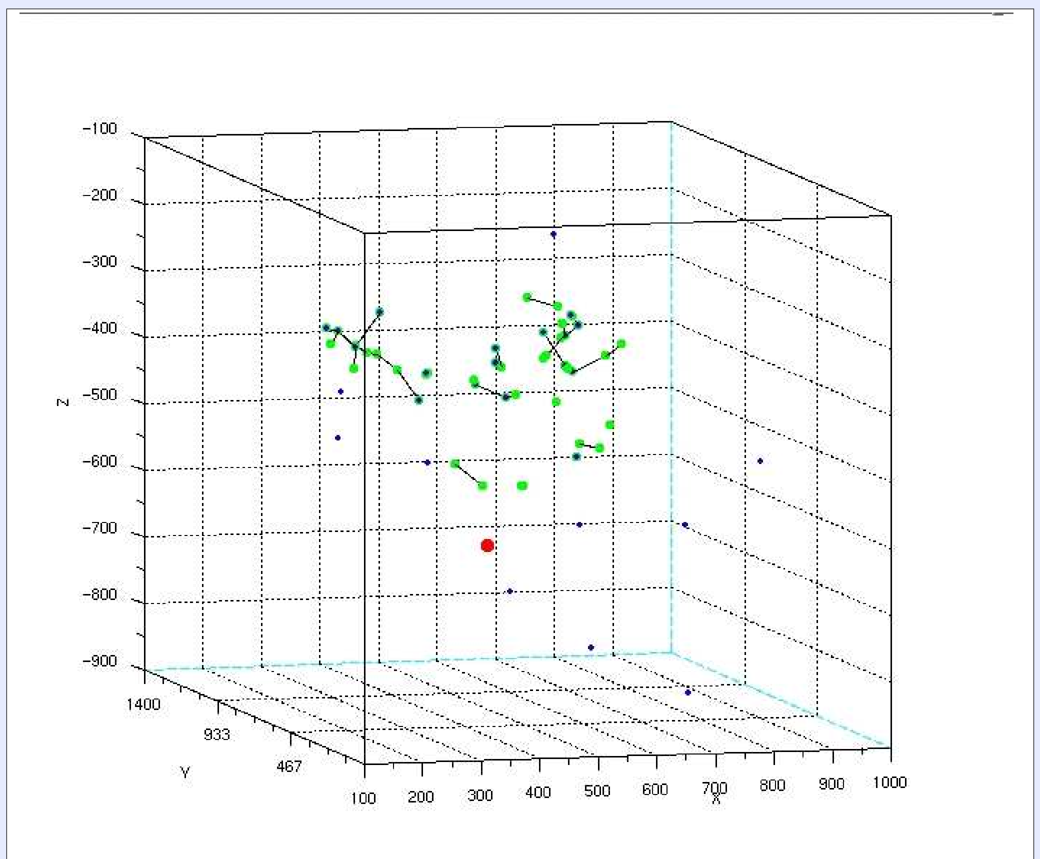

Fig. 4: The 3D view of the filament and pair members (green balls) and isolated (blue) dwarf galaxies in the Lynx-Cancer void. The large red ball shows the position of the conditional void center.