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Mass and Spatial Distributions of Subhaloes in ΛCDM Cosmological Simulations

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Abstract. We study subhalo populations surrounding massive dark matter haloes by using three AMIGA simulations each having different mass and spatial resolutions. Our analysis shows that the slope of the subhalo mass function has a value 0.9, which agrees with previous studies. The dependence of mass functions on redshift is the same for subhaloes and main haloes. In all simulations, combined subhalo masses are about 0.1-0.2 of main halo masses and this mass fraction increases slightly with redshift and the mass of the main halo. The distribution of mass fractions for subhaloes is close to Gaussian at $z = 0$ and differs slightly at earlier epochs. Spatial distribution of subhaloes as measured in units of virial radius R_{vir} of the main halo does not depend on redshift and follows $r^{1/3}$ rule. Spatial distribution of all haloes surrounding main haloes continues up to 3 times R_{vir} with equal slope but lower amplitude. Beyond 16 times R_{vir}, the average distribution of haloes becomes uniform.

Keywords. Methods: n-body simulations, Cosmology: miscellaneous-dark matter

1. Description of the project

We have run three ΛCDM cosmological simulations with different resolutions and volumes: 10 Mpc/h, 40 Mpc/h and 80 Mpc/h. Mass resolutions are 4.47×10^6 $M_\odot$/h, 2.86×10^8 $M_\odot$/h and 2.29×10^9 $M_\odot$/h, respectively. The code used in the calculations is the AMIGA package (previously MLAPM) developed by Knebe *et al.* (2001). We identified main haloes and their subhaloes using the MHF (Gill *et al.* 2004) specifically designed to work together with AMIGA.

The general aim of this project is to study subhalo content of the haloes, the properties of subhaloes and to investigate how the surroundings of main haloes and different properties of subhaloes are correlated with environment and formation history. In the first stage (Nurmi *et al.* 2006) we have analysed the distributions of mass fractions and mass functions and compared the results to earlier estimates (Gao *et al.* 2004).

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References

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