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THE IDILICO PROJECT. DYNAMICAL EVOLUTION OF COMPACT GROUPS. SUPERCOMPUTER SIMULATIONS

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IDILICO (Investigation of the DIffuse LIght COmponent in compact groups of galaxies) is an international collaboration created with the aim of performing high-resolution N-body simulations of the dynamical evolution of groups of galaxies on supercomputers like the MareNostrum at the Barcelona Supercomputing Center.

Initially born to investigate the origin of the extraordinarily large fractions of diffuse intragroup light (~ 50%) of the total found in some Hickson's compact groups (e.g. Da Rocha & Mendes de Oliveira 2005), IDILICO has become nowadays a more ambitious research project that intends to address other critical, unanswered questions, such as how the properties of galaxies evolve in the group environment.

On a first stage, our simulations are addressed to investigate whether the prominent dip seen in the composite galaxy luminosity function of poor groups with little or no X-ray gas (Miles et al. 2004) might arise from the preferential merging of intermediate-luminosity galaxies taking place during the initial phase of collapse, before galaxy halos are tidally truncated and merger rates decline. The fact that we want to follow the evolution of galaxy groupings only until they collapse for the first time implies that the large-scale environment of the groups plays no role on the dynamics. The structure of the group and galaxy models is chosen in accordance with the predictions of the standard "concordance" ΛCDM cosmology. Groups are represented by bound systems, which at high redshift consist of a few L^* galaxies with at least 30 fainter companions on a smooth background of DM particles expanding altogether with the Hubble flow, with primeval density contrasts that lead to their first collapse at $z \sim 0$.

Galaxies are represented by live Navarro-Frenk-White DM halos surrounding either an exponential disk or a Hernquist spheroid of stars. The total mass of the galactic halos, drawn randomly form a Schechter probability density function, determines via an analytical galaxy model the properties of both the halo and its inner stellar distribution, which are in this way linked to the underlying cosmology. The stellar mass-to-light ratio of the galaxies, on the other hand, is a free parameter whose value is chosen to guarantee that the structural and kinematical properties of these objects are condesistent with observations in the local universe.

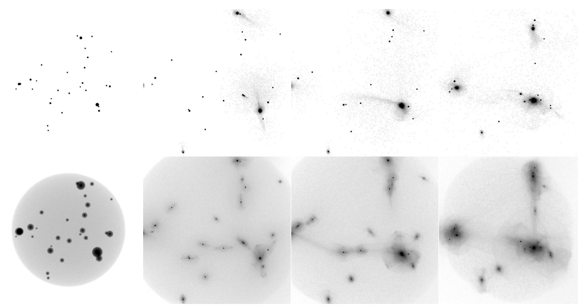

Fig. 1. Evolution of the dark (bottom) and luminous (top) matter density in a simulation of a low-mass poor group of spheroidal galaxies made of 107 mass particles initially distributed among 30 galaxy halos with virial masses drawn from a Schechter mass function, with $M/M^* \geq 0.01$ and $\alpha = -1.3$, and a uniform common background of dark matter The number of background DM particles is 6068361 (~ 61% of the total). The simulation starts at $z = 3$ (leftmost images) and is evolved for 6 time units (rightmost images), representing about 10 Gyr, until the present epoch.

Here we present an illustrative example of the kind of preliminary simulations we are running to determine the feasibility of our hypothesis, as well as the initial configurations that are better suited for our investigation (Figure 1).

REFERENCES

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