THE GALAXY MASS DISTRIBUTION FROM MERGERS IN A COLLAPSING SPHERICAL CLUSTER

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We examine the role of mergers in the formation and statistics of galaxies and clusters of galaxies. First steps in this direction were carried out by Shaviv & Shaviv (1993, ApJ.Lett., 412, L25) where the 0D case was treated. The work is extended to examine the effect of self gravity. Thus, we essentially explore the combined effect of violent relaxation and mergers on the resulting structure and mass distribution of galaxies in clusters of galaxies. We developed a numerical method to treat the spherical 2D problem (radial position and velocity) of the evolution of a collapsing cluster of gas clouds (Shaviv & Shaviv, 1995, ApJ., 448, 514).

We have succeeded to show that: 1. Unlike the 0D case, which does not depend on the initial conditions, the 1D case depends on the initial density distribution. This is so because the initial density distribution determines the rate at which various layers fall in and consequently they control the merger rate. 2. The upper part of the distribution has an asymptotic shape of the following form: $N(m) \sim (m/\overline{m})^{-\lambda} \exp(-\beta m/\overline{m})$, where both λ and β depend on the parameter α of the cross section merging, and unlike the zero dimensional case, they depend on the initial geometry. $\overline{m}$ is the mean mass. For evolved systems, the time dependence is only through $\overline{m}$. 3. The radial distribution of the mean galaxy mass is found and compared with the observations. We find that for those parameters of the galaxy-galaxy merger for which the observed Shechter luminosity function is reproduced, also the mean mass distribution agrees with the observations. 4. The total number of galaxies as a function of radial distance, or in other words, the total mass density as a function of radial distance, agrees with the observations as well.

The present approach relies on the dynamics of two body interactions and should be contrasted to the hierarchical model where many body interact simultaneously.

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