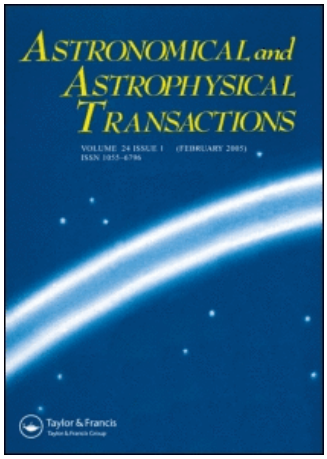

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Simulation of galaxy mergers in clusters and groups: "Explosive" evolution

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SIMULATION OF GALAXY MERGERS IN CLUSTERS AND GROUPS: "EXPLOSIVE" EVOLUTION

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Monte Carlo simulation of galaxy mergers in clusters is carried out. A galactic mass and angular momentum distribution function is found. The "explosive" character of the formation of the mass function is confirmed (an analogue of a phase transition: Cavaliere *et al.*, 1992; Kontorovich *et al.*, 1992). The appearance of a "new phase", cD-galaxies, is traced. Comparison with the Butcher–Oemler effect and the observed steepening of the luminosity function at the faint end is carried out.

KEY WORDS Galaxy mergers, simulations

We present simulation of pairwise galaxy mergers in a system which consists initially of $N_0 = 10^4$ low-mass galaxies with exponentially decreasing mass function. Mergers were assumed to conserve mass and angular momentum (with the orbital momentum); the merger probability depends on the masses of the colliding galaxies as $U \propto (M_1 + M_2)^2$ for $M \ll M_b$ and $U \propto (M_1 + M_2)(M_1^{1/2} + M_2^{1/2})$ for $M \gg M_b$ (the homogeneity power is $u = 2$ and $u = 3/2$, respectively) (Krivitsky and Kontorovich, 1996). Both the pure cases $u = 2$, $u = 3/2$ (which correspond to very large or small values of M_b) and the mixed case were considered. Mergers result in the formation of a distribution tail, corresponding to massive galaxies, and a "new phase": cD-galaxies (Figure 1). The average slope of the mass function in the region of the tail is ≈ 2.5–3 for $u = 2$ and ≈ 2 for $u = 3/2$ (Figure 2). In the latter case the slope is between the values $(u + 3)/2$ (constant mass flux along the spectrum) and $(u + 2)/2$ (constant flux of the number of particles, which corresponds to conservation of the number of massive galaxies when they merge with small ones). An average value of the dimensionless angular momentum

$$\Lambda = \frac{S}{MR(2GM/R)^{1/2}}$$

in the tail does not depend on the mass for $u = 3/2$ and decreases with mass for $u = 2$ (the latter corresponds to the dominating contribution of mergers between

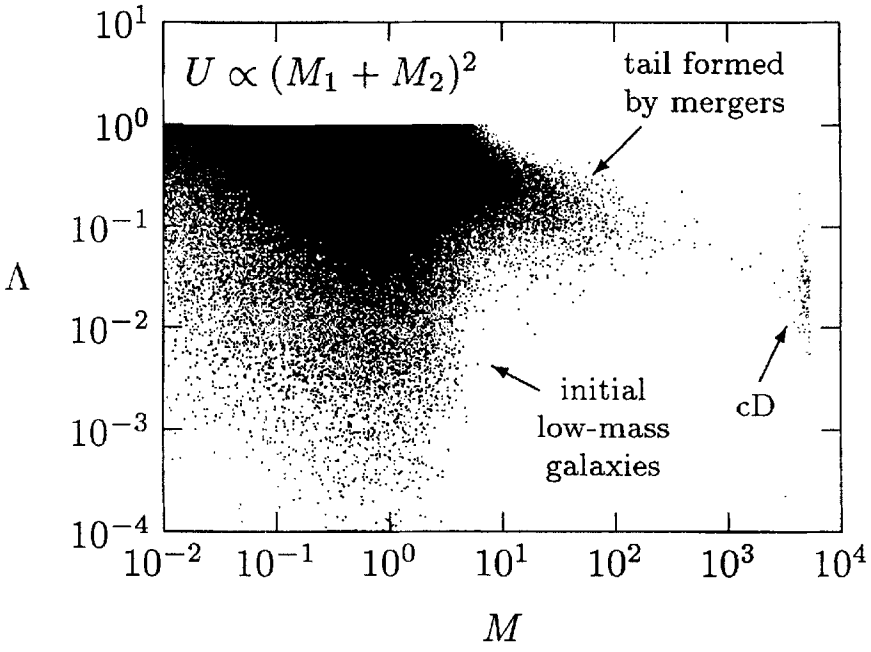

Figure 1

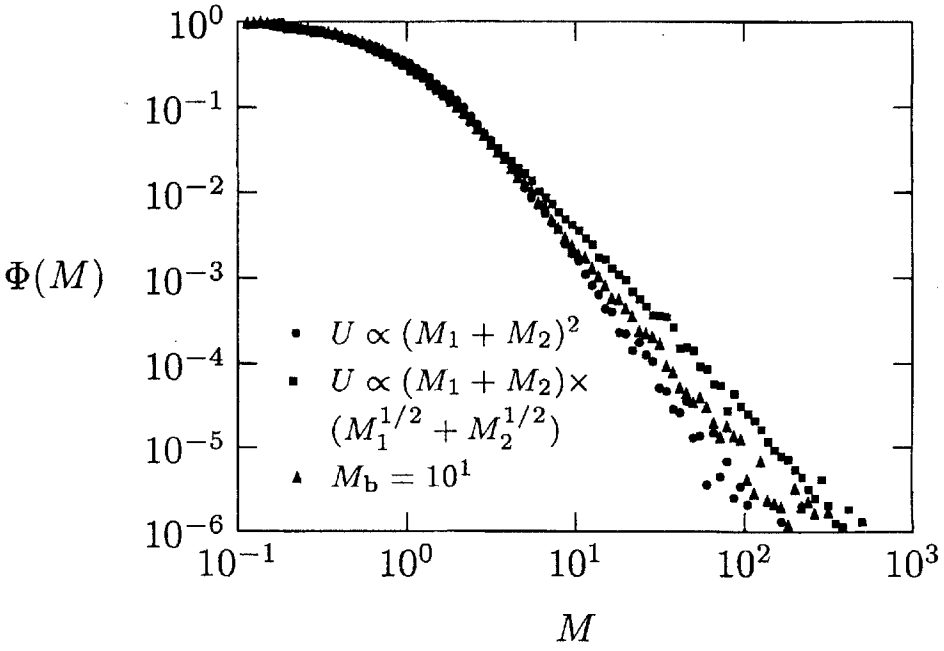

Figure 2

low-mass and high-mass galaxies). The momentum distribution varies along the tail and is non-Gaussian for the cD-galaxies.

Due to the considerable contribution of mergers between a comparatively small number of apparently massive galaxies and low-mass ones, the time t_{cr} corresponding to the "phase transition" is much less than the characteristic time $(\sigma v n)^{-1}$, where σ is the merger cross-section for typical galaxies, n is the concentration of such galaxies, and v is the average velocity. At late stages of cluster evolution collective effects and space inhomogeneity related, in particular, to the presence of the cD-galaxy must be taken into account.

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