Formation of slowly rotating elliptical galaxies in major mergers. A Resolution Study

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Abstract. We study resolution effects in numerical simulations of gas-rich (20% of the total baryonic mass) major mergers, and show that the formation of slowly-rotating elliptical galaxies requires a resolution that is beyond the present-day standards to be properly modelled. Our findings show that a high-enough resolution is required to accurately model the global properties of merger remnants and the evolution of their angular momentum. The role of wet mergers of spiral galaxies in the formation of slow-rotating ellipticals may therefore have been underestimated.

Keywords: galaxies: formation – galaxies: elliptical and lenticulars, cD – galaxies: interactions – galaxies: kinematics and dynamics – methods: N-body simulations
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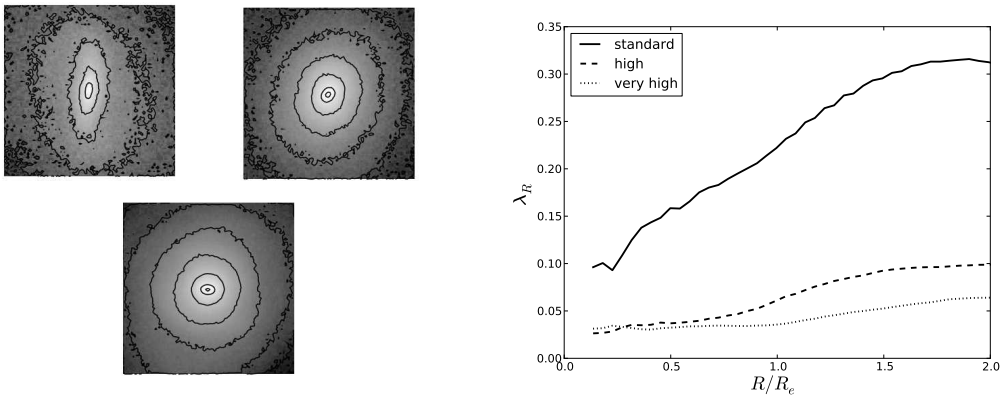

FIGURE 1. Intensity fields (16×16 kpc^2, top left : standard, top right : high, bottom : very high resolution) and λ_R profiles for the three realisations at different resolutions of the simulation.

Numerical simulations have been intensively used to study the properties of the remnants of galaxy mergers and the role of hierarchical merging in the formation of elliptical-like early-type galaxies [3, 1, 4]. A general concern, though, is the impact of the spatial and the mass resolutions on the detailed properties of these systems. From a large sample of numerical simulations of binary galaxy mergers (see Bois et al., in prep) made at the *so-called* high-resolution (6×10^6 particles and a softening length of 80 pc), we have selected a slowly rotating elliptical galaxy [2] and we have re-simulated this typical configuration at a present-day standard-resolution (5×10^5 particles and a softening length of 180 pc) and at a very high-resolution (3.6×10^7 particles and a softening length of 32 pc).

As seen in Fig. 1, the systems that are slow rotators at high resolution rotate more rapidly when the resolution decreases, and can be observed as true fast rotators at standard resolution (including the formation of a bar). Gas at *standard-res* largely lies in smooth structures, and the formation of new stars during the merger proceeds in a relatively smooth way. At increased resolutions, thinner gas structures are resolved during the merger, which can result in structured and clustered star formation. These local density peaks are accompanied by rapid variations of the gravitational potential, which help scatter stellar orbits, evacuate the angular momentum, and form, for specific orbits, slow-rotating early-type galaxies (see Bois et al., 2009, submitted).

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