The Interplay among Black Holes, Stars and ISM in Galactic Nuclei
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The role of circumnuclear SSCs in the formation of small bulges

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Abstract. We present simulation results about the interplay between super star clusters (SSCs) and the host dark-matter (DM) halo, with emphasis on the formation of bulges in very late-type galaxies. Simulations show that the NFW halo close to a stable state has no significant response to sinking of circumnuclear SSCs. Generally speaking, while the halo becomes hotter, its central cusp survives. The structures of the formed bulges are similar to what we obtained with fixed NFW halos, but the bulge formation fraction at various stages are smaller.

1. Bulge formation scenario

A possible scenario leading to the formation of bulges with certain structures from circumnuclear SSCs can be briefly depicted as follows. In a DM halo, circumnuclear SSCs move inwards due to the effect of dynamical friction, and drop their mass on their way due to the effect of tidal stripping. Some SSCs can sink down to the nuclear region and a bulge with structures is formed from both the stripped and the remaining parts of these SSCs.

2. Simulation results

In this report, we present preliminary results about the interplay between SSCs and the host DM halo, with emphasis on the formation of bulges in very late-type galaxies. Following the standard ΛCDM N-body simulations, we assume the NFW density profile for the initial stable DM halo, constructed basically from an energy-dependent distribution function. Except for allowing the evolution of the DM halo, the models are the same as in Huang et al (2003).

Simulations show that the density profile of the DM halo changes only a little during the scenario, in particular, its central cusp generally survives the coexistent effects of gravitational contraction and heating expansion caused by the interplay between the DM halo and the sinking SSCs.

As shown in Fig.1, the formed bulges share the same characteristics with the HST observational results (Carollo 1999), i.e. the general presence of central cusps on top of the exponential bulges. This result is similar to our previous ones with fixed NFW halos (Fu et al. 2003, Huang et al. 2003). However, as illustrated in Fig.2, the bulge formation fraction at various stages are smaller than those obtained with fixed NFW DM halos (100% at about $1000 \sim 1500 Myr$ after the SSC formation). This is mainly due to the fact that the evolving halo is heated by the sinking SSCs.

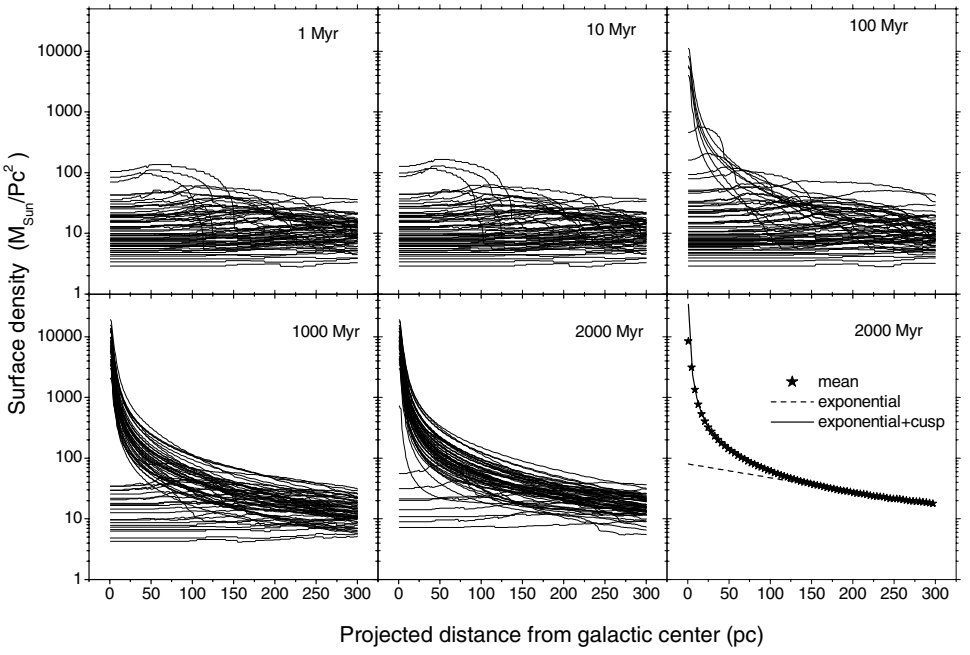

Figure 1. Evolution of the surface density profiles of simulated galaxies.

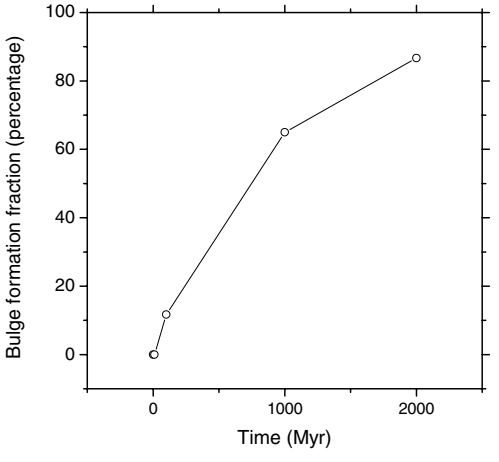

Figure 2. Bulge formation fractions.

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