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Rotation of classical bulges during secular evolution of barred galaxies

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Abstract. Bar driven secular evolution plays a key role in changing the morphology and kinematics of disk galaxies, leading to the formation of rapidly rotating boxy/peanut bulges. If these disk galaxies also hosted a preexisting classical bulge, how would the secular evolution influence the classical bulge, and also the observational properties.

We first study the co-evolution of a bar and a preexisting non-rotating low-mass classical bulge such as might be present in galaxies like the Milky Way. It is shown with N-body simulations that during the secular evolution, such a bulge can gain significant angular momentum emitted by the bar through resonant and stochastic orbits. Thereby it transforms into a cylindrically rotating, anisotropic and triaxial object, embedded in the fast rotating boxy bulge that forms via disk instability (Saha *et al.* 2012). The composite boxy/peanut bulge also rotates cylindrically.

We then show that the growth of the bar depends only slightly on the rotation properties of the preexisting classical bulge. For the initially rotating small classical bulge, cylindrical rotation in the resulting composite boxy/peanut bulge extends to lower heights (Saha & Gerhard 2013). More massive classical bulges also gain angular momentum emitted by the bar, inducing surprisingly large rotational support within about 4 Gyrs (Saha *et al.* in prep).

Keywords. galaxies:bulges, galaxies: evolution, galaxies: structure

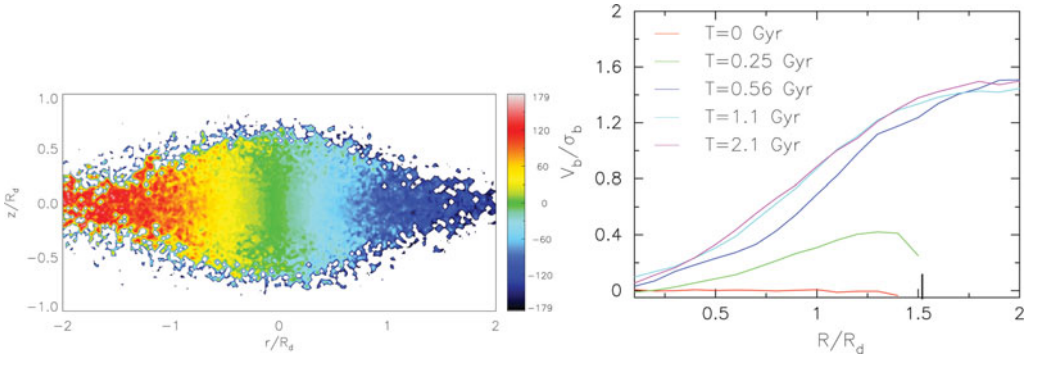

Figure 1. Line-of-sight velocity map showing cylindrical rotation of the classical bulge particles at time 2.1 Gyr in the Saha *et al.* (2012) model (left). Variation of rotation velocity with radius and time during secular evolution (right).

References

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