Galaxy Evolution across the Hubble Time
Proceedings IAU Symposium No. 235, 2006
F. Combes & J. Palouš, eds.

doi:10.1017/S1743921306010295

The role of the gas in the bar instability. A cosmological approach

Anna Curir[1], Paola Mazzei[2], and Giuseppe Murante[1]

[1]INAF-Astronomical Observatory of Torino, ITALY
email: curir@oato.inaf.it, murante@oato.inaf.it

[2]INAF-Astronomical Observatory of Padova, ITALY
email:paola.mazzei@oapd.inaf.it

Abstract. The growth and the evolution of the bar instability in stellar-gaseous disks embedded in a dark matter halo evolving in a cosmological framework is explored. We point out the impact of different gas fractions on the bar formation, inside disks of different disk-to-halo mass ratio.

Keywords. galaxies: spirals, structure, evolution, halo; cosmology: theory

1. Method and Discussion

We performed eight cosmological simulations of a disk+halo system inside a cosmological framework : a ΛCDM model with Ω_m =0.3, Ω_Λ =0.7, σ_8 =0.9, h =0.7. One simulation was followed in an isolated framework, using a NFW halo, to disentangle the effects of the dynamical state of the halo, and in particular of the evolutionary framework, on the growth of the bar instability.

In the most massive disks (simulations c1, c2 and c3 in Table 1) we find a threshold value (0.2) of the gas fraction able to destroy the bar. The stellar bar strength is enhanced by the gas and higher gas fractions increase the bar pattern speed. The DM dominated disks (simulations c4, c5, c6, c7 and c8 in Table 1) show indeed a behaviour which is strongly driven by the cosmological halo properties as in Curir *et al.* (2006). These disks show a bar until the end of their evolution, regardless their gaseous fraction. Such a result is not expected in the classical isolated framework. The bar pattern speed for these disks is very low and is not affected by the gaseous component.

The behaviour of these simulations suggests a play between three parameters which drive the bar formation and dissolution in cosmology: the gas fraction inside a suitable disk radius, r_g, the r_g value itself, and the halo-to-disk mass ratio inside the disk radius.

Reference

Curir, A., Mazzei P., Murante G. 2006, A&A, 447, 453

Table 1. Simulations

N	M_{disk}	gas fraction	ϵ	a_{max}
c1, c2, c3	0.3	0.1, 0,2., 0.4	0.7, n, n	8.4, n, n
c4, c5, c6, c7, c8	0.1	0.1, 0.2, 0.4, 0.5, 0.6	0.6, 0.6, 0.5, 0.5, 0.4	5.8, 5.4, 5.6 5.4, 5.8
i1	0.3	0.2	n	n

I col: simulation number and type (c: cosmological simulation, i: isolated simulation inside a NFW halo); II col: mass of the disk in code units (i.e. $5.9 \times 10^{10}\, M\odot$); III col: gas–to–disk mass ratio; IV col: maximum bar ellipticity at $z = 0$, n = no bar; V col: major axis (kpc) at $z = 0$, n = no bar.