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Elliptical Galaxies Since $z \sim 1.5$: The Evolution of The Fundamental Planes

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Abstract. We use a set of hydrodynamical, self consistent simulations operating in the context of a concordance cosmological model where relaxed elliptical-like objects (ELOs) were identified at different redshifts. ELOs at different redshift are well described by the Sérsic (1968) function. We also obtain a good comparison with observational scaling relations. These results indicate that ELOs conform a homogeneous population at any redshift, except that high z ELOs tend to be more compact that their lower z counterparts. Also, scaling relations point to the rupture of the structural homology.

Keywords. methods: n-body simulations; hydrodynamics; galaxies: fundamental parameters; galaxies: elliptical and lenticular, cD; galaxies: evolution

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We have studied the structural properties of elliptical galaxies using hydrodynamical simulations operating in a cosmological context. The code used in our simulations is DEVA (Serna *et al.* 2003). We have run five simulations where elliptical-like-objects (ELOs) have been identified at redshifts $z = 0$ $z = 1$ $z = 1.5$. We have analyzed how suitable the Sérsic law, $I^{\rm light}(R) = I_0^{\rm light} exp[-b^n (R/R_e^{\rm light})^{1/n}]$, is to describe the light distribution of virtual ellipticals, at low and intermediate zs, and wheter or not elliptical samples are structurally homogeneous with z. We have checked that the quality of the fits to the Sérsic is good and roughly independent of the redshift. This result points to the homogeneity of the relaxed ELOs population with respect to z (Domínguez-Tenreiro *et al.* 2006 and references therein). However, we also find that most massive high z ELOs tend to be more compact that their lower z counterparts.

Some well-known scaling relations between the Sérsic parameters are analyzed: i) the shape parameter, n, and the projected stellar half-mass radius, $R_{e,ob}^{star}$. ii) The line-of-sight velocity dispersion, $\sigma_{los,0}^{star}$, and n. iii) The stellar mass, M_{ob}^{star}, versus n. We have compared these relations with observational data (D'Onofrio *et al.* 2001, Vazdekis *et al.* 2004) obtaining good agreement. The results of a direct fit of the form $\log n = \alpha_i \log x_i + \beta_i$ for each relation indicate that the projected stellar mass density of an ELO varies accordingly to its mass. This result points to the rupture of the structural homology in ELOs, that is, large galaxies are more centrally concentrated that smaller ones. This has consequences on the tilt of the Fundamental Plane and it also explains the preservation of the tilt with z when seen in the edge-on projection (Oñorbe *et al.* 2005 and references therein).

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