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Characterization of peculiar early-type galaxies in the local universe

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Abstract. Early-type galaxies (ETGs) have been characterized as objects dominated by old stellar populations, containing little or no cold gas and dust, and thus, non-existent star formation. However, there are indications in the literature that some ETGs deviate from this: some have significant amounts of gas and dust, are forming stars, and/or display stellar substructures (tidal features, disks or shells, e.g., Kormendy *et al.* 1997, Rix, Carollo & Freeman 1999). A better understanding of the evolution of ETGs and the details of their "peculiarities" is critical to properly constrain models of galaxy formation. We present preliminary results on a photometric analysis of substructures in local ETGs, based on 3.6μm IRAC images from the Spitzer Survey of Stellar Structure in Galaxies (S^4G; Sheth *et al.* 2010), which comprises one of the largest mid-IR photometric surveys of the local Universe. Relatively unhindered by extinction and dominated by the low-mass stellar populations that dominate a galaxy's stellar mass budget, the IR is the ideal waveband to trace the details of stellar structures in galaxies. Based on 2D GALFIT (Peng *et al.* 2002) decomposition, we find tidal features in 17% of 146 ETGs from S^4G. For both the GALFIT model and the galaxy residual images, we calculate the total counts inside an annular region centered on the galaxy, where the inner radius is the effective radius of the galaxy. Assuming that a tidal feature and its host galaxy have the same mass-to-luminosity ratio (M/L), the ratio of the residual counts over model counts translates into the ratio of their stellar masses. We find that the tidal features in the majority of peculiar ETGs in our sample account for no more than 11% of the galaxy's total stellar mass. Considering that simulations (Canalizo *et al.* 2007) suggest an upper limit in relative stellar mass of 25% for shells resulting from a past major merger, the values we find support a merger origin. We are in the process of applying the decomposition method to GALEX UV images and optical SDSS images of these peculiar ETGs in order to characterize the underlying substructure and provide constraints on astrophysical properties such as star formation rates and stellar masses associated to these tidal features, based on broad-band SED template fitting techniques.

Keywords. galaxies: elliptical and lenticular, galaxies: structure, galaxies: evolution

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