The intriguing life of massive galaxies
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Probing the Build-Up of Stellar Mass in the Center of IR Luminous Major Mergers with HST

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Abstract. Interactions and mergers are important drivers of galaxy evolution, transform spiral galaxies into massive ellipticals, and fuel both powerful starbursts and massive nuclear black holes. In particular one galaxy population, namely Luminous Infrared Galaxies (LIRGs), are believed to be responsible for most of the star formation that happened in the history of the universe (see e.g. Le Floch *et al.* 2005, Caputi *et al.* 2007, Magnelli *et al.* 2009), and hence represent a critical phase in the evolution of galaxies where most of the galaxies mass is building up. During a merger process, violent relaxation acts on stars present in gas-rich progenitor disks, while the centers are structured by the relics of dissipational, compact starbursts, imprinting a central "extra light" component or "cusp" into the surface brightness profiles of merger remnants. Our *HST* NICMOS/WFC3 imaging program of the 88 most luminous LIRGs in the Great Observatories Allsky LIRG Survey (GOALS, see Armus *et al.* 2009) shows that the central luminosity surface density in nearby LIRGs increases significantly along the merger sequence, indicating that the gas inflow fuels a central starburst and subsequently builds a compact stellar cusp (Haan *et al.* 2011). A large fraction of all galaxies in our sample possess double or multiple nuclei (∼63%). Half of these double nuclei are not visible in the *HST* B-band images due to dust obscuration, which implies strong limitations on the ability to detect the true nuclear structures of luminous infrared galaxies at high-redshift (z > 2) and may explain some of the apparent discrepancy of the LIRG population and merger ratio between local and high-redshift galaxies. We find that ULIRGs ($\log[L_{IR}/L_\odot] > 12.0$) have significantly smaller nuclear separations than LIRGs ($\log[L_{IR}/L_\odot] = 11.4$ — 12.0) with a median value of 1.2 kpc and 6.7 kpc, respectively. In our sample, merger (regardless of whether LIRG or ULIRG) seem to be prevalent at two time scales (based on the projected nuclear separation and mass ratio of the nuclei): First, at a remaining merger time scale of $0.3 < [t - t_{merg}] < 1.3$ Gyr (53% of mergers in our sample), and second, at $[t - t_{merg}] \sim 0$ (26%), likely representing the first passage of interacting galaxies and the final nuclear coalescence, respectively, with a post-merger time (starburst phase after the nuclei merged) of roughly 300 Myrs.

Keywords. galaxies: interactions, galaxies: nuclei, galaxies: starburst, galaxies: structure, cosmology: observations

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