The mass distribution of S^{4}G galaxies

S. Díaz-García, H. Salo and E. Laurikainen

Astronomy Research Group, University of Oulu, FI-90014 Finland
email: simon.diazgarcia@oulu.fi

We use 3.6 μm photometry for 1345 galaxies from the Spitzer Survey of Stellar Structure in Galaxies (S^{4}G, [1]) to trace the old stellar structure of nearby disk galaxies with total stellar masses $10^{8.5} < M_*/M_\odot < 10^{11}$ and Hubble types $-3 \leq T \leq 10$. We aim at characterizing the stellar density profiles, the bars, and the disk contribution to the circular velocity in spiral galaxies, providing observational constraints for galaxy formation models to be tested with. We re-scale galaxy images to a common frame determined (i) by the size of their disks in physical units, (ii) by their estimated scale-length (taken from [2]), and (iii) by both the length and orientation of the galactic bars that they host (taken from [3]). We stack the resized images to obtain statistically representative average stellar disks and bars in bins of M_* and T.

We provide possible observational evidence for bar-induced secular evolution of galactic disks. For a given M_* bin, we find a significant difference in the stellar density profiles of barred and non-barred systems: (i) disks in barred systems have larger scale-lengths and lower central surface brightnesses ([4]), and (ii) the median surface brightness profiles of barred and non-barred disk stacks intersect each other slightly beyond the median bar length, probably at the bar corotation. On average, the stacked galaxy profiles in our sample show exponential disks without breaks for all M_* and T (down to $\sim 2 M_\odot \mathrm{pc}^{-2}$), but the bin of galaxies with the largest tidal interaction strength presents an up-bending median profile. The prominence of (pseudo)bulges strongly depends on the total mass and morphological type of the host galaxy, and so does the shape of the disk contribution to the rotation curves. We show that the bars in early-type systems have larger m=2 Fourier density amplitudes and lower gravitational torques, the latter being related to the force dilution by bulges (e.g. [5],[6]). We find a clear agreement between quantitative estimates of the bar strength and the RC3 galaxy class.

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