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THE STELLAR STRUCTURES AROUND DISK GALAXIES

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We present a brief summary of current results on the stellar distribution and population gradients in disk galaxies, and discuss future prospects of follow-up imaging and spectroscopic research using the GTC with OSIRIS & EMIR.

Faint extended stellar structures have been detected around many nearby disk galaxies of different morphological types over past decade, but their nature has been a matter of some debate. Today, we know that the scale length and height of a stellar population in the disk galaxies increase with age, with oldest detected red giant branch population (RGB) identified at large galactocentric radii or extraplanar height, out to typically a few kpc. The extraplanar height of the thick disk in low mass disk galaxies is systematically larger than the young thin disk of giant spirals (see Figure 1), suggesting that stars in low-mass galaxies form in a thicker disk. In the most massive of the studied galaxies (highest circular velocity), there is evidence for a break in number density and color gradients of evolved RGB stars, which plausibly correspond to the transition from the thick disk to the evasive stellar spheroid, the halo (e.g., Tikhonov, Galazutdinova, & Drozdovsky 2005).

These results, however, are mainly based on the photometric studies of resolved stars. The large collecting area and high-throughput multi-object instruments on the GTC, OSIRIS in visual and EMIR in near-IR, will provide new type of imaging and spectroscopic studies of resolved stellar populations in various nearby galaxies.

We selected for the GTC program five prominent Local Group disk galaxies, NGC 6822, NGC 3109, IC 1613, IC 10 and Leo A to study the radial (inplane) and vertical (extraplanar) gradients as a function of stellar age. Based on our space- (Hubble & Spitzer) and ground-based telescopes study, target galaxies possess an extended structure lacking young stars. Our GTC observations will include single-

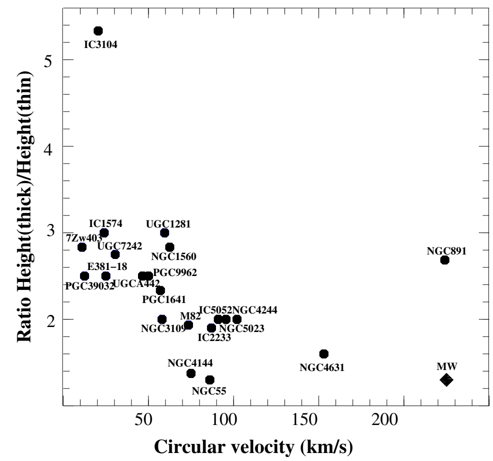

Fig. 1. Ratio of thick- to thin- disk height as a function of the rotational speed of H I for the high-inclination galaxies, based on the distribution of resolved stars (e.g., Tikhonov 2006).

star spectroscopy (for both, chemical abundances and kinematics) of the brightest intermediate-age stars, and deep imaging aimed at reaching the old ($\sim$ 10 Gyr) stellar population, such as horizontal branch (HB) stars – signposts of an ancient stellar populations (see also Gallart et al. 2007). Additionally, by extending this analysis to the near-IR with EMIR we will complement our imaging and spectroscopic research with a complete census of stars with IR excess, like evolved AGB stars, which strong stellar wind is an important factor of chemical evolution of galaxies. We will target the outermost fields for our study of the true extent of stellar structures.

When complemented with detailed chemical abundances and kinematic information from the spectra of these stars, our optical/near-IR photometric data will allow us to shed light on fundamental questions about the evolution of disk galaxies, such as disk heating versus merger scenarios and a role of these mechanisms in forming the stellar disks and halo.

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