Are small bulges in low-σ spiral galaxies disk-like systems?

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The current paradigm about bulges separates them into two main categories, namely classical and disk-like bulges. Since they are thought to be produced by different physical mechanisms, estimating their fraction in local galaxies is crucial to understand galaxy evolution in general. In particular, unveiling the properties of low-mass bulges will undoubtedly have a strong impact on the current models of galaxy formation.

Based on the different formation scenarios, several observational criteria has been proposed to separate the two classes of bulges (Kormendy et al. 2016). Among the others, disk-like bulges are oblate ellipsoids (Méndez-Abreu et al. 2010) reminiscent of disks and low-σ outliers of the Faber-Jackson (FJ) relation, with their kinematics dominated by rotation (Kormendy & Kennicutt 2004). By contrast, classical bulges appear rounder than their associated disks, and their stellar kinematics is dominated by random motions that generally satisfy the fundamental plane (FP) correlation (Aguerri et al. 2005).

In a recent work, we have challenged this picture using a sample of 9 bulges with high spectral resolution at the end of the Hubble sequence (Costantin et al. 2017). We have used quantitative estimates of the photometric and kinematic properties to study their location in the FP and in the FJ scaling relations (Fig. 1). We have found that the sample bulges satisfy some of the photometric and kinematic prescriptions for being considered disk-like bulges such as small sizes and masses with nearly exponential light profiles, small bulge-to-total luminosity ratios, and low stellar velocity dispersions. However, each of them also follows the same scaling relations of ellipticals, massive bulges, and compact early-type galaxies which are defined for virialized systems. This implies that our bulges cannot be classified as disk-like systems. In fact, we have found that all bulges can be described as a single population of galaxy spheroids that follow the same scaling relations. The mass seems to lead to a smooth transition in the photometric and kinematic properties from less massive bulges to more massive bulges and ellipticals.

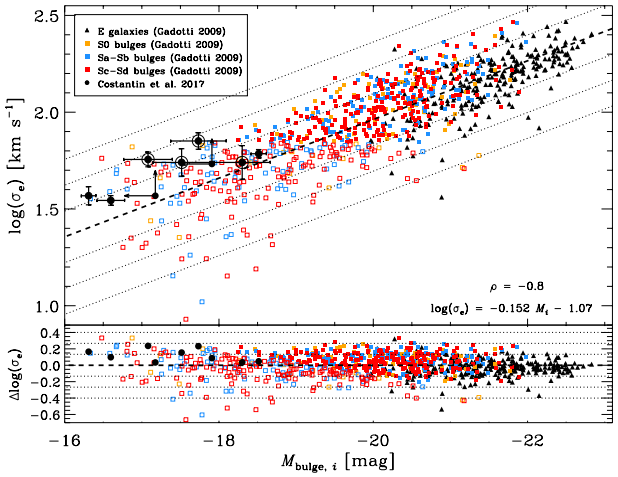

Figure 1: Faber-Jackson relation for massive bulges and ellipticals from Gadotti (2009) and small bulges from Costantin et al. (2017).

References

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