

Dissecting early-type dwarf galaxies into their multiple components

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Abstract. Early-type dwarf galaxies are often thought to be either more diffuse versions of giant ellipticals or to be low-mass disk galaxies that were quenched and heated by the environment. In both cases, the picture that most astronomers have in mind probably is that of a dynamically hot, regular shaped galaxy, in which any previous substructure has either been smeared out, or has never been there. However, the early-type dwarfs are not that simple.

We analyzed ~ 100 such objects in the Virgo cluster using deep near-infrared images and found that the majority has a multi-component structure, sometimes even with bars or lenses. The study was done by applying GALFIT to images from the SMAKCED collaboration (Stellar content, *M*Ass and *K*inematics of *C*luster *E*arly-type *D*warfs, <http://www.smakced.net>). The sample comprises early-type galaxies in the Virgo cluster in a brightness range of $-19 \leq M_r \leq -16$ mag, and the data is complete down to $M_r = -16.73$ mag. The images typically reach a signal-to-noise ratio of 1 per pixel of $\sim 0.25''$ at a surface brightness of ~ 22.5 mag/arcsec² in the *H*-band. The galaxies were fitted with two-dimensional models, either with a simple Sérsic model or inner and outer components, as well as bars and lenses. Only a fraction of 31% of the galaxies can be fitted with a single Sérsic function. This fraction of “simple” galaxies turns out to be a strong function of luminosity, with a smaller fraction for brighter objects. The bar fraction is 14% and also in 14% of the galaxies lenses were fitted.

When comparing the flattening distribution, the early-type dwarfs are more similar to spiral galaxies than to elliptical or lenticular galaxies. It is disputable whether or not the dwarfs follow a common relation with the bright elliptical galaxies, e.g. in the brightness versus size diagram. At the same time, they appear as smooth continuation of bright late-type galaxies in this diagram. The inner and outer components, as well as the simple galaxies have similar flattening distributions. The inner components are mostly fitted with Sérsic-*n* values close to 1, i.e. with nearly exponential profiles. We argue that the inner components in the early-type dwarfs are not be bulges but may form parts of the disks, in which the matter was re-distributed during the transformation process from a late-type progenitor.

Keywords. galaxies: dwarf — galaxies: photometry — galaxies: structure — galaxies: clusters: individual: (Virgo Cluster)

References

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