DWARF GALAXIES IN THE FORNAX CLUSTER

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ABSTRACT. We present the results of an observational study of the dwarf galaxies in the Fornax cluster of galaxies.

We present the results of an observational study of the dwarf galaxies in the Fornax cluster of galaxies. The data consist of optical and infrared photometry, multi-color CCD imaging, and near-infrared spectroscopy. Nearly thirty of the one hundred dwarf galaxies known in this cluster have been observed. The results can be summarized as follows.

(1) Most of the dwarfs are low-surface elliptical systems similar in all respects to those found in the Virgo cluster. There seems to be a slight deficiency of dwarf irregulars in the cluster with respect to the Virgo cluster. The dwarf galaxies that appear to be forming stars are far from the center of the cluster

(2) From UBVJHK photometry and infrared Ca II spectroscopy, we surmise that most of the systems have old, metal-poor stellar populations. There are several elliptical systems which clearly have star formation regions, however, and one very low surface brightness elliptical galaxy is simply too blue to be explained by low metallicity.

(3) A high proportion of the dwarfs are nucleated. The luminosity of the nucleus is well correlated with the color of the galaxy, in the sense that the more nucleated dwarfs tend to be redder. There is rarely any measurable difference in the color of the nucleus and the surrounding halo.

(4) Outside of the nucleus, the light profile falls off exponentially

T. de Zeeuw (ed.), *Structure and Dynamics of Elliptical Galaxies*, 455–456.

in most cases. Interesting exceptions include a dwarf in which an exceedingly large core radius exists, so large that 25% of the luminous mass of the galaxy resides in the constant density region. General conclusions about the structure of elliptical systems (from the giant ellipticals to the dwarf spheroidals) can now be made. From -23 to -18, a decrease in luminosity is produced by a decrease in radius, since the central surface brightness increases as luminosity decreases. Since the slope of the profile becomes steeper with decreasing luminosity, there is a slight increase in isophotal surface brightness with decreasing luminosity for those galaxies, although the surface brightness at any metric radius outside of the nucleus decreases as the galaxies get less luminous. The light distribution can be represented by a power law in the inner regions and an exponential in the outer regions. The exponential region tends to begin at smaller isophotal radii in the fainter galaxies.

For galaxies with luminosities between -18 and -15, the principal factor in causing a decrease in luminosity is a decrease in the central surface brightness (ignoring the nucleations), thus resulting in a shallower radial light profile in the inner regions. The radius decreases only slowly and hence there is a strong dependence of isophotal surface brightness on luminosity. The light distribution can be well represented by an exponential, although the profiles of the brighter galaxies tend to have more of a power law slope in the inner regions.

Galaxies fainter than -15 show a variety of structures, some with very large core radii, some whose limiting radii are abnormally small, leading to surface brightnesses that are high for their luminosities. The light distribution is approximately exponential for these galaxies.

(5) Dwarf ellipticals in general share the same structure as blue compact dwarfs (BCD's), but are quite distinct from dwarf irregulars, in that the irregulars have significantly larger scale lengths at a given surface brightness. Present day dwarf ellipticals did not evolve from present day dwarf irregulars because the amount of fading due to aging of the stellar population in the irregular would render them much fainter than present day dwarf ellipticals. In fact, they would become undetectable with photographic plates.

(6) Because of the relation between color and brightness of the nucleus, we think the nuclei were probably formed from material that was enriched from stellar mass loss and probably after the main body of the galaxy was formed. Since there is only rarely a color difference between the nucleus and the halo, the formation of these metal-enriched stars probably occurred in the halo as well. Whether a galaxy held on to its interstellar gas for a second round of star formation was probably dependent on how many supernovae exploded in a short amount of time. That is, the success in doing so was random event. One or two of the galaxies observed in the Fornax cluster may be in the process of forming a nucleus.

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