Chapter IX

Poster Papers

Cluster Systems in Distant Galaxies

Deep Photometry, CM Diagrams

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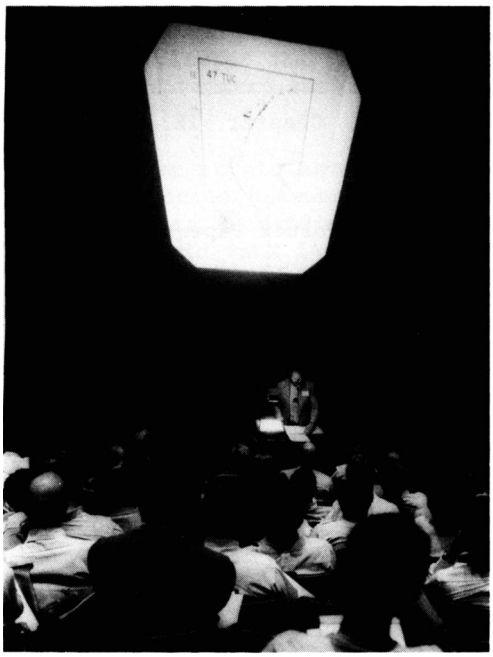
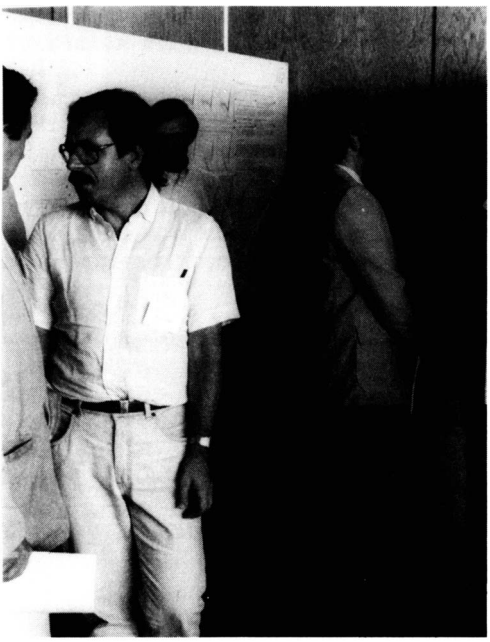


Jim Hesser and a well-known globular cluster captivate the crowd



Roberto Buonanno with a cluster of globular luminaries

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THE NUCLEI OF NUCLEATED DWARF ELLIPTICAL GALAXIES - ARE THEY GLOBULAR CLUSTERS?

H. Zinnecker[1], C. J. Keable[2], J. S. Dunlop[2]
R. D. Cannon[1] and W. K. Griffiths[3]

Royal Observatory, Edinburgh 1
University of Edinburgh 2
Leeds University 3

It came as a great surprise that many dwarf elliptical galaxies of very low surface brightness in the Virgo Cluster have conspicuous bright star-like nuclei (Reaves 1983, Binggeli, Sandage and Tammann 1985). These nuclei are at least a factor of 10 more luminous than the brightest globular clusters in the Local Group and comparable only to the very brightest globulars surrounding M87. They contain a considerable fraction (1 to 20%) of the total light of the parent galaxy (Binggeli, priv. commun.). Their physical nature and origin are a matter of debate (Zinnecker *et al.* 1985, van den Bergh 1985, Norman 1986, Zinnecker 1986) but optical spectroscopy for 3 objects indicates a stellar composition with a range similar to globular clusters (Bothun *et al.* 1985). It has been suggested that a central nucleus is formed when off-center bound star clusters migrate to the center as a consequence of dynamical friction (Norman 1986). Support for such a scenario comes from CCD observations of IC 3475 which reveal numerous knots near the center of this dwarf irregular galaxy (Vigroux *et al.* 1986). These knots have the same color as the parent galaxy and are interpreted as intermediate age star clusters.

We have obtained CCD observation in BRI at the 2.5 m Isaac Newton Telescope on La Palma for 3 nucleated dwarf ellipticals in the Virgo cluster (VCC 1185, VCC 1348, VCC 1539) in an attempt to study the colors and magnitudes of the nuclei. Exposure times were typically 5 min in each filter. The seeing was about 1".5 and the pixel size corresponded to 0".74. Although the frames were not taken under good photometric conditions, we could analyse the data to check for color differences between the nuclei and their parent galaxies. Wavelength-dependent seeing differences were the main complication in determining the color profile for small apertures. We have measured the flux from both the starlike nuclei and nearby reference stars, using a range of numerical apertures. The color (B-R) for both classes of object show the same variations with aperture diameters: for apertures 5".0 both star and nucleus redden by approximately the same amount, but with larger apertures the colors remain roughly constant (see Fig. 1). Therefore we conclude that to within 0.1 in (B-R) the star-like nuclei have the same color as the galaxies as a whole. This would be consistent with the IC 3475 observations and the above scenario for the origin of the nuclei. More work needs to be done to corroborate this conclusion.

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 603–604.

Finally, we draw attention to the possibility that the nucleated dwarf ellipticals, when accreted and disrupted by a larger galaxy such a M 87, would contribute their naked nuclei as a population of globular clusters while the rest of the body of dwarf ellipticals would add to the halo stars of the giant galaxy.

More likely perhaps, dwarf spiral or dwarf irregular galaxies which contain knots (i.e. big star clusters) could, when swallowed by a larger galaxy, supply many if not all the globular clusters of that large galaxy directly (i.e. before dE nuclei are formed). In this way, not only would one avoid the accretion of over-massive clusters but also increase the number of accreted clusters. It is intriguing to realize that the ratio of mass in the knots to the mass in the bulk of some dwarf galaxies seems to be of the same order of magnitude (10^{-2} to 10^{-3}) as the ratio between the total mass comprised by globular clusters and the total mass of halo field stars in an ordinary large spiral or elliptical galaxy.

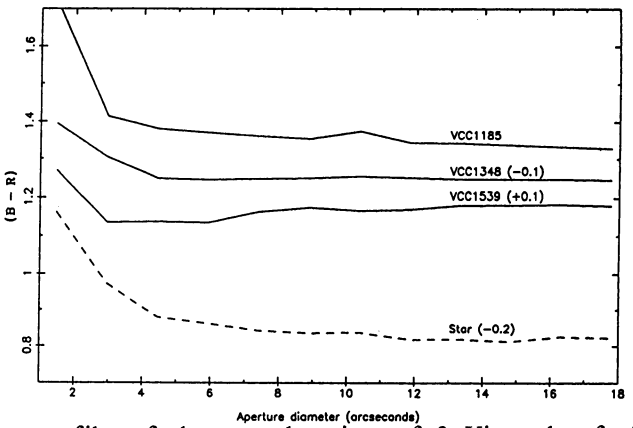

Fig. 1. Color profiles of the central regions of 3 Virgo dwarf elliptical galaxies. Comparison with the color profile of a reference star (dashed line) shows that the reddening of the innermost regions is a seeing artifact.

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