BV CONCENTRIC APERTURE PHOTOMETRY OF GLOBULAR CLUSTERS

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Globular clusters are among the most difficult types of objects to observe with standard photoelectric techniques. Among factors which may contribute to measurement error are the centering of apertures in the oftentimes diffuse cores of clusters, the random distribution of bright stars near the cluster centers, and the determination of an adequate sky correction in fields badly crowded by foreground stars. These problems have been well-discussed by a number of authors (see, e.g., Hanes and Brodie 1984, and the references they cite).

The most comprehensive published tabulation of photoelectric data has been the study by Kron and Mayall (1960). Other observers have observed more limited samples of clusters for determination of total magnitudes, for determination of colors for chemical abundance or interstellar absorption studies, and for comparison of observed luminosity growth curves with the predictions of dynamical models based on the spatial distribution of the individual stars within the clusters.

As many clusters still had not been studied adequately for proper comparison with dynamical models, we began in 1976 a program of observations at Cerro Tololo Inter-American Observatory of as many of the globular clusters of our Galaxy as possible. Multi-aperture photometric observations were obtained during 28 complete or partial nights during the years 1976 to 1980. Approximately 4000 V and B measurements were made with the 0.4, 0.9, 1.0, and 1.5 meter telescopes with the use of various series of aperture sizes; 101 clusters in the Milky Way Galaxy and 1 cluster which is a member of the Small Magellanic Cloud system were observed. These data together with data from all other sources are being used for a reassessment of cluster central surface brightnesses, cluster total magnitudes, and cluster structural parameters as defined in the self-consistent dynamical models of King (1966; see also Peterson and King 1975 and Peterson 1976).

As discussed elsewhere in this symposium, high resolution surface photometry shows that surface brightness profiles in the central regions of only a small number of the globular clusters of our Galaxy

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deviate from the predicted profiles of the simple King models; hence, for most clusters the original concept of the core radius is still valid. Seitzer (this symposium) has argued that the tidal radii of the King models are valid limiting radii as set by the gravitational tidal field of the Galaxy; tidal or limiting radii may be determined observationally only by detailed star counts in the outer regions of clusters. Concentric aperture photometry converted to the radial variation of surface brightness ties together the high resolution photographic and CCD studies in the cluster centers with the deep star count studies in the outer regions to produce overall structural profiles of the clusters which can be compared to the models of King or others. Of importance to note is that the present observational work does show the existence of systematic errors in some of the older photometric data which in turn may have led to a few errors in our original estimations of cluster structural parameters.

A preliminary assessment of cluster color (B - V) as a function of radius is also now underway. The data suggest, in agreement with the conclusion of Hanes and Brodie (1984), that, in general, radial color gradients in globular clusters are extremely difficult to detect if they are real; repeated observations especially with very small aperture sizes show that single measurements may be subject to very large errors probably due to the statistical distribution of a few very bright stars near the cluster centers.

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REFERENCES

Hanes, D.A., and Brodie, J.P. 1984, M.N.R.A.S., pre-print.
King, I.R. 1966, Astron. J. **71**, 64
Kron, G.E., and Mayall, N.U. 1960, Astron. J. **65**, 581.
Peterson, C.J. 1976, Astron. J. **81**, 617.
Peterson, C.J., and King, I.R. 1975, Astron. J. **80**, 427.