Use of DPOSS data to study globular clusters tidal radii

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Tidal radii of globular clusters (GCs) are important tools for understanding the complex interactions of GCs with the Galaxy. They, in fact, have traditionally been used to study the mass distribution of the galactic halo (Innanen, Harris, & Webbink 1983), or to deduce GCs orbital parameters (Freeman & Norris 1981; Djorgovski 1996). So far, tidal radii have been estimated mainly by fitting King models to cluster density profiles, i. e. with an indirect procedure which often leads to contradictory results. Only in the last few years it has become possible to effectively deal with the overwhelming problem of contamination from field stars and directly probe the outer region of GCs (cf. Grillmair et al. 1995; Zaggia et al. 1995, 1997; Lehman & Sholz 1997). Available tools to enhance cluster star counts (SCs) against field stars rely on the color-magnitude diagram (CMD), proper motions, radial velocities, or a combination of the three, with the CMD being the more economical and powerful method. These techniques have led to the discovery that tidal or extra-tidal tails are a common feature of GCs. In this poster we discuss the results of the use of Second Palomar Sky Survey (DPOSS) plates to measure the tidal radius of the globular cluster M92 (NGC 6341).

1. DPOSS data and M92 color magnitude diagram

This work has been made in the framework of the CRoNaRio (Caltech-Roma-Napoli-Rio de Janeiro) collaboration: an extension of a long term project started at Caltech in 1993 (Djorgovski et al. 1992) aimed at the construction of the so called Palomar Norris Sky Catalog: i.e. a complete photometric and astrometric catalogue of all objects present on the DPOSS comprising an estimated number of 2×10^9 stars and 5×10^7 galaxies. More details on DPOSS and CRoNaRio can be found respectively in Djorgovski et al. (1997) and in Andreon et al. (1997). Plate processing and catalogue construction is performed by means of the software SKICAT written at Caltech (Weir et al. 1995).

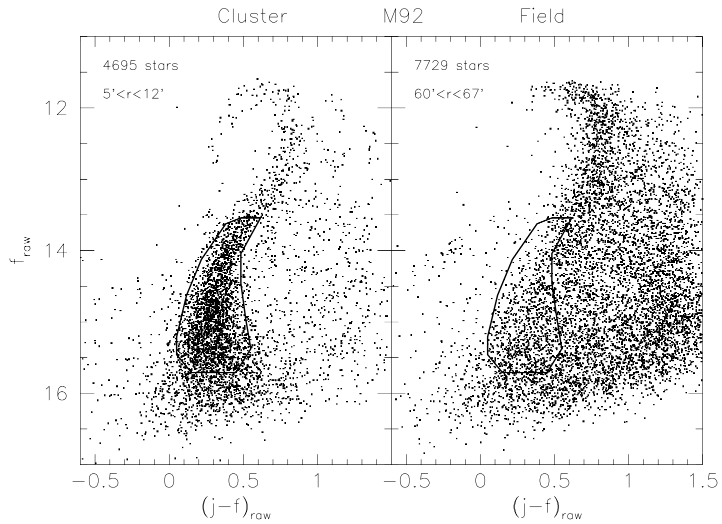

Figure 1. Left panel: CMD of M92 in an annular region at $5' \div 12'$. Right panel: background field CMD in an annulus at $60' \div 67'$.

M92 falls in the DPOSS field n.278. From the B_J and R_F plates an area of 136×136 sq. arcmin centered on M92 was extracted and SKICAT procedure were used to attain relative photometric calibration through the available calibration spots. The linearised images were then processed through DAOPHOT-II (Stetson 1987). Aperture photometry was performed from the linearized DPOSS plates. The choice of using DAOPHOT instead than SKICAT in the highly crowded regions of M92 will be discussed in detail elsewhere (Andreon et al. 1998, in preparation). In Figure 1 we show the uncalibrated CMD of M92 and of its nearby regions: it is clearly visible the M92 turn-off region and part of the horizontal branch. At large angular distances from M92 most objects are galactic stars with only a small contribution from the cluster stars. In both panels of Figure 1 a contour marks the CMD region used to select the stars in order to decrease the importance of field SCs. This selection reduced SCs by a factor$\sim$ 7.

2. M92 radial density profile

From the CMD-selected star sample we built a bidimensional surface density map of the cluster and of its surroundings and fitted a polynomial surface to subtract the background SCs. A plane was sufficient to interpolate the background SCs: we tested also higher order polynomials finding no substantial improvements over the adopted solution. The cluster radial density profile was then obtained from the background subtracted SCs by counting stars in annuli of equal logarithmic steps. The crowding corrected SCs of M92 derived from DPOSS data is shown in Figure 2 as filled dots and it is compared with existing density profile (Trager et al. 1995), and with the isotropic King model derived from the published parameters of Trager et al. (1995). It can be clearly seen that observed SCs deviate from a King model in the outermost regions of the cluster thus revealing the presence of extra tidal material.

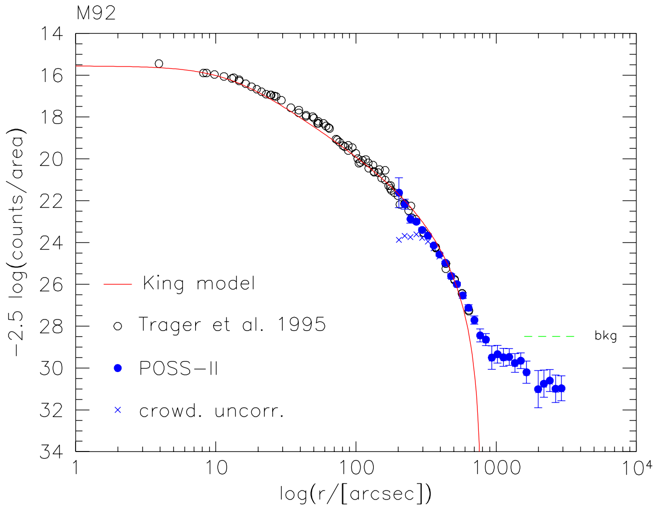

Figure 2. M92 radial density profile. Open dots, Trager et al. (1995) data; filled dots, DPOSS SCs; crosses, crowding uncorrected SCs; solid line, isotropic King model.

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