RevMexAA (Serie de Conferencias), **18**, 78–79 (2003)

SURFACE BRIGHTNESS PROFILES OF GALACTIC GLOBULAR CLUSTERS

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RESUMEN

Se presentan los perfiles de brillo superficial para 28 cúmulos galácticos. Los perfiles son imágenes en diversos filtros del archivo de la cámara WFPC2 del HST. El perfil de brillo superficial para obtener la densidad de luminosidad es un importante medio de estudio de cualquier sistema dinámico. En particular la pendiente central del perfil de densidad superficial puede tener efectos significativos en la evolución del sistema. Los perfiles se obtienen midiendo la luz residual despues de restar las estrellas más brillantes, y combinando este perfil con el que se obtiene de conteos estelares. Se ha reportado que los cúmulos de esta muestra presentan una variedad de formas de brillo superficial, desde núcleos colapsados hasta muy bajas concentraciones. Los resultados muestran que la pendiente logarítmica interior para el perfil de densidad de luminosidad cubre un intervalo continuo desde 0 a 1.7 en vez de mostrar separación entre núcleos aplanados y perfiles muy empinados.

ABSTRACT

We present surface brightness profiles for 28 galactic globular clusters. The profiles come from archival images of the WFPC2 camera on HST using a variety of filters. An important tool for studying any dynamical system is using the surface brightness profile to obtain the luminosity density. In particular, the central slope of the luminosity density profile can have a significant effect on the system evolution. The profiles are obtained by measuring residual light after subtracting the brightest stars, and combining this profile with that obtained from star counts. The clusters in our sample are reported to have a variety of surface brightness shapes, from core-collapse to very low concentration. The results show that the inner logarithmic slope for the luminosity density profile spans a continuous range from zero to 1.7 instead of dividing in flat cores and very steep profiles.

Key Words: **GLOBULAR CLUSTERS : GENERAL**

1. DATA REDUCTION AND ANALYSIS

Our goal is to obtain accurate surface brightness profiles, and hence, luminosity density profiles, at small radii for a large sample of globular clusters (GC). We collected a sample of 28 GC imaged with WFPC2. The requirements were that the cluster center was on one of the chips and that the exposure times were adequate to obtain a good signal (>100 sec). The images are in V, R or I filters. Our sample covers a wide range in concentration ($0.79 < c < 2.5$) and also in mass. The 2.6 arcmin x 2.6 arcmin field is adequate to measure out to 2 half light radii for most of the clusters.

Using DAOPHOT, we find stars and construct a PSF for every image. The residual light from the subtracted images provides a smoother surface brightness profile than the one obtained from the original image, due to shot noise from the individual bright stars. Substituting the outer part of the profile with a best fit King model allows us to obtain the luminosity density profile directly. We thus, are able to measure the central slopes for both projected and deprojects stellar density.

Most of the recent studies on GC use parametric models to derive dynamical parameters, usually single or multi-mass King-Mitchie models from fits to surface brightness profiles. Some authors (Merrit & Tremblay 1994, Gebhardt & Fischer 1995) are questioning this approach saying that parametrical models might not reveal the true nature of the system but instead bias it by the functional form of the model. For this reason we use a non-parametrical analysis technique. We obtain the luminosity density profile by smoothing the surface brightness profile and then deprojecting it with the Abell integral.

We obtain the inner slope of both the surface brightness and luminosity density profiles for the entire sample. A King profile has a slope of zero in the center in both cases. The central slopes shapes span a continuous range, as opposed to a bimodal distribution. Fig 1 shows a histogram of the central slopes for both profiles. All except one of the clusters with

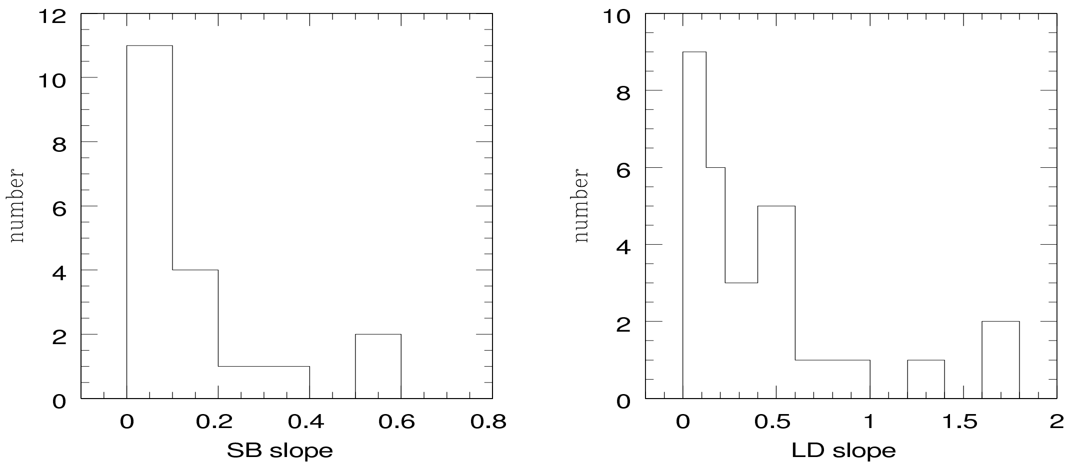

Fig. 1. Histogram of central slopes for the entire sample

slopes steeper than 0.2 in surface brightness, are reported as core-collapse by Trager et al (1995). The expected slope for core-collapse is -1.64 to 2.2 for the different mass components on the cluster (Murphy & Cohn 1988). For the case of a GC with a black hole in the center Bahcall & Wolf (1977) predict slopes from 1.5 to 1.7, depending on mass components.

2. CONCLUSIONS

The central slopes of the luminosity density profiles for the sample span a continuous range between zero and 1.7. If we use only King models, core collapse models or black hole models, we cannot reproduce the central slope distribution that we measure.

Future dynamical modeling will reveal the importance of these slope distribution.

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The eighth Mexico-Texas Conference on Astrophysics: Energetics of Cosmic Plasmas (Mexico City, Mexico, 31 October - November 2, 2002)
Editors: Mauricio Reyes-Ruiz & Enrique Vazquez-Semadeni