DEEP HST/FOC OBSERVATIONS OF THE CENTER OF M15[1]

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Abstract. We present preliminary results of the analysis of a set of *Hubble Space Telescope*/Faint Object Camera images of the center of M15, the prototypical post-core-collapse globular cluster. We rule out, at the 95% confidence level, the 2.″2 core claimed to be detected in pre-repair *HST* imaging. We also measure a mass function in a field 20″ from the center.

The advent of the repaired *Hubble Space Telescope (HST)* has made it possible to study the dense cores of globular clusters in unprecedented detail. The telescope's high spatial resolution allows us to observe the distribution of *faint* stars in these crowded regions—a capability that is crucial is we wish to understand these clusters' dynamical state.

We observed three $7 \times 7''$ fields in M15 on 27 September 1994; two near the cluster center, and one at $r \simeq 20''$. (A portion of the former images is reproduced in King's paper in this volume.) All were observed in the FOC equivalents of B (F430W) and V (F480LP), for ~2000 seconds in each color. The resulting images show stars down to $V \simeq 22$ in the inner fields, and down to $V \simeq 24$ ($\sim 0.5 M_\odot$) in the outer field.

We used the standard DAOPHOT software to produce lists of stellar positions and magnitudes, with a few additions—such as an algorithm to reject false detections in diffraction rings—that will be described more fully in an upcoming paper (Sosin & King, in preparation).

The completeness-corrected surface-density profile of stars with V magnitudes between 18.5 (just above the main-sequence turnoff) and 20.0 is shown in Figure 1. All of these 839 objects have nearly the same mass. The sample is $> 90\%$ complete over most of its radial range. Improvements to

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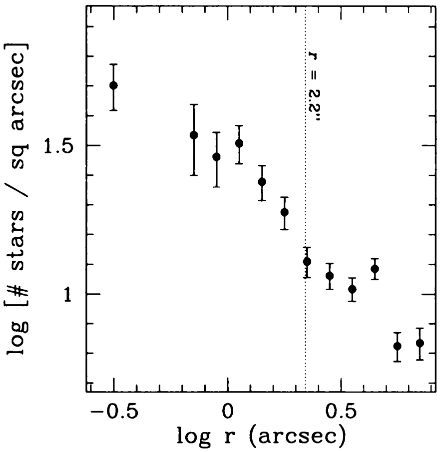

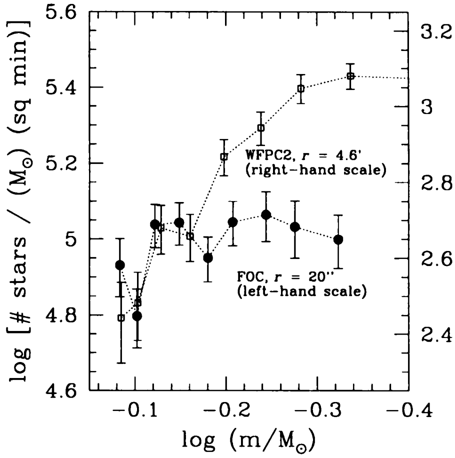

Figure 1. (*left*) The surface-density profile of stars with $18.5 \leq V \leq 20.0$.
Figure 2. (*right*) The mass function at $r = 20''$, and at $r = 4'.6$.

the bad-object rejection algorithm are currently being developed, and it should soon be possible to extend the analysis to fainter magnitudes.

The surface-density profile clearly continues to climb steadily within $2''$. The $2''.2$ core found in pre-repair *HST* work by Lauer *et al.* (1991) (and subsequently questioned by Yanny *et al.* [1994]) is *not* seen in these data; using a maximum-likelihood method, we rule out a $2''$ core at the 95% confidence level. We cannot distinguish at present between a pure power-law profile and a very small core.

The lesser degree of crowding in the $20''$ field allows us to measure a mass function (MF), shown in Figure 2. The counts have been corrected for incompleteness, and the magnitudes converted to masses via the mass-luminosity relation of D'Antona & Mazzitelli (1995). The best-fitting power-law slope of the MF at $r = 20''$ is -0.99 ± 0.5, where the Salpeter value is 1.35.

We also show the mass function at $r = 4'.6$, as measured in a WFPC2 image (Piotto, Cool, & King, in preparation). The zero points of the two plots (*i.e.,* the left- and right-hand scales) are chosen so that the two MFs appear to overlap at the high-mass end, to emphasize their substantial difference at lower masses—the result of dynamical mass segregation.

References

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Lauer, T. *et al.* 1991, ApJ, 369, L45
Yanny, B., Guhathakurta, P., Bahcall, J., & Schneider, D. 1994, AJ, 107, 1745