MAIN SEQUENCE PHOTOMETRY OF KRON 3

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ABSTRACT

The globular cluster Kron 3 in the Small Magellanic Cloud presents an interesting opportunity to study stellar evolution in a population of intermediate age populous enough to contain many stars in short-lived phases of their evolution. The cluster lies approximately two degrees west of the body of the SMC and just outside the tidal radius of the Galactic globular cluster 47 Tuc.

THE COLOR-MAGNITUDE DIAGRAM

We note the following significant features:

1. Kron 3 has a distinct turnoff population starting at R = 21.5.

2. The giant and subgiant branches are well delineated.

3. The horizontal branch (HB) has a "C" shape which opens towards the giant branch. The HB qualitatively resembles a Sweigart and Gross track for a HB star with $0.20 < Y < 0.30$, $Z = 0.001$, and $M = 0.6 - 0.8\ M_{\odot}$. The width of the blue turning point constrains the dispersion in HB masses (and mass loss on the first giant branch) to $\sigma < 0.01 M_{\odot}$, and the narrow luminosity range constrains the cosmic dispersion in Y to be $\sigma(Y) < 0.01$.

4. There may be a gap below the main sequence turnoff. It is clearly visible in the high quality sample of 169 stars, persists in the large sample of 459 stars, and also appears in the observed luminosity functions of all samples. If it is real, and analogous to the hydrogen core exhaustion gaps in old open clusters, it is very interesting because theory does not predict such a gap in this range of age and composition.

5. The SMC background has well delineated subgiant and horizontal

S. van den Bergh and K. S. de Boer (eds.), Structure and Evolution of the Magellanic Clouds, 45–46.

branches, both of which coincide with Kron 3 within $0^m.01$ in R and B-R. We conclude that the Kron 3 and local SMC background Fe-peak element abundances differ by no more than 0.1 dex.

6. The background has an old turnoff population fainter than that of Kron 3; at R = 22, there is an increase in the luminosity function and a pronounced Hertzprung gap.

7. There is a sequence of blue stars in the field sample which are more luminous than the turnoff population. The widespread occurence of young populations in the SMC confirms that this is a young main sequence.

THE AGE

Isochrone fits were made using the Yale tracks for [Fe/H] = -1.3 and Y = 0.20 transformed to the observational plane using Kurucz model atmospheres. The tracks were reddened by A_R = 0.09 and E(B-R) = 0.064, and the fit placed the turnoff at R = 22.2. Values for the SMC distance modulus reported in the literature cluster about two means of 18.8 and 19.3, and fits yielded ages of 8 and 6 Gyr, respectively. These ages are corrected to Y = 0.25, in agreement with recent determinations for the SMC, as well as the primordial He abundance. The turnoff of the SMC field is fainter than that of Kron 3. Considering that this region of the SMC contains many other older objects, including NGC 121, the background field may be the oldest population in the SMC.

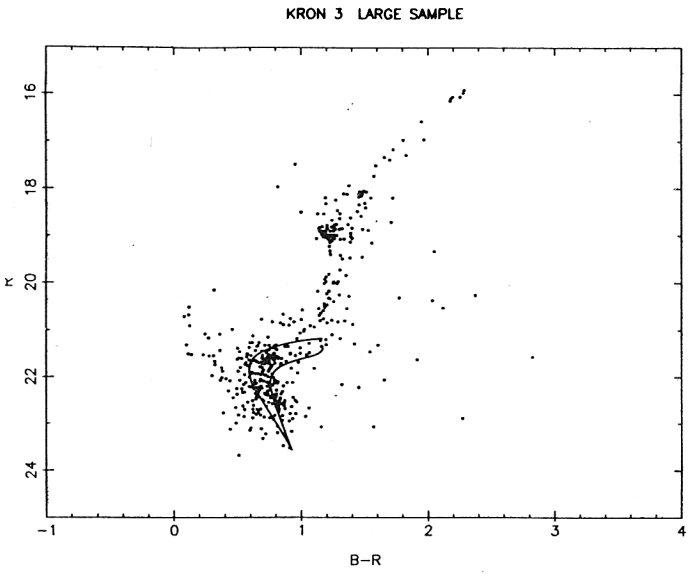

Figure 1
The Color Magnitude Diagram of Kron 3 with 6 and 8 Gyr isochrones superposed.

https://doi.org/10.1017/S0074180900039875 Published online by Cambridge University Press