COMBINED VISUAL AND NEAR-IR DIGITAL PHOTOMETRY: THE VERY YOUNG CLUSTER WESTERLUND 2

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ABSTRACT: We discuss CCD UBVRI and NICMOS3 JHK observations of the young open cluster Westerlund 2, with emphasis on both reduction techniques and absolute calibrations.

The optical images were carried out with the 1-m telescope at the Sutherland station of the South African Astronomical Observatory using the RCA 512 x 320 CCD camera. IR data were obtained at the 2.2-m MPI/ESO telescope at La Silla (Chile) using the new NICMOS3 256 x 256 IR camera IRAC2. The reduction of the IR images will be discussed in the light of the instrumental problems which were identified during the observing run, when the camera was still under test. Flat fielding will also be addressed. It is shown that, despite the problems, the photometric performance of the new camera was quite good, which provided us with accurate infrared photometry.

This multi-band data set allows us to derive accurate values for age and distance to the cluster. We can also study in detail the cluster's stellar content, providing mass and temperature of individual stars. For the optical images, the standard procedure of de-biasing and flatfielding was adopted to get uniform pixel response.

The IR data were reduced by subtracting from the object images a linear combination of the corresponding skies and dividing the results by a flatfield obtained on the morning or evening sky. This technique has the advantage of removing automatically bias and dark current, but any star in the sky frames will appear as a hole in the final frame. The flatfields were prepared by subtracting a low-signal image from a high-signal image obtained with the same integration time. This procedure was adopted (with the K filter in particular) to deal with certain structures in the raw images that are a function of integration time but not of incident flux. The flatfield images were then normalized to unity in order not to alter the intensity of

A. G. Davis Philip et al. (eds.), New Developments in Array Technology and Applications, 355–356.
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https://doi.org/10.1017/S0074180900056771 Published online by Cambridge University Press

the science images during the division process. Both sets of data have been reduced using the package for crowded fields photometry DAOPHOT II (Stetson 1987), running in MIDAS.

Magnitudes were measured on each frame by fitting stars with the best choice PSF (Daophot routine ALLSTAR). For both optical and IR data, the most isolated stars were used to link the aperture-photometry magnitudes to the instrumental ones obtained from the fitting, to calculate and remove the aperture correction. Finally, we discarded all stars with an internal magnitude error, as provided by ALLSTAR, of 0.18 mag.

Figs. 1 and 2 show the V, (B-V) and the K, (J-K) CMDs respectively. The optical data are comparable with, or better than, those presented by Moffat et al. (1991). The absolute calibrations in both the optical and the near infrared are quite good and will allow us a thorough investigation of W2, which will include photometric membership classification based on the reddening to each individual star, age and distance through isochrone fitting, luminosity function and initial mass function (including correction for the contribution of the pre-main sequence stars). The whole set of diagrams, the details concerning data acquisition and reduction, and the full astrophysical discussion comprehensive of the comparison with Moffat et al., will be published in a forthcoming paper (Guarnieri et al., 1994).

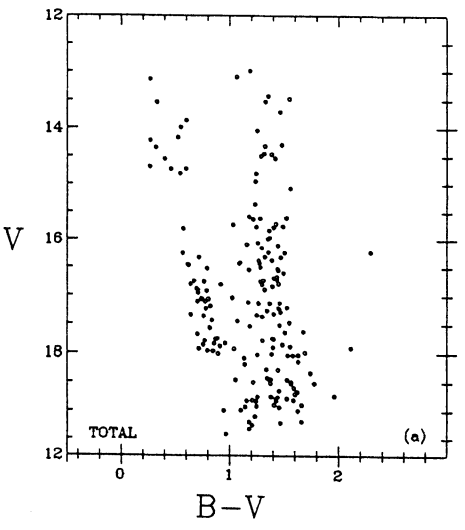

Fig. 1. (V, B-V) CMD of Westerlund 2.

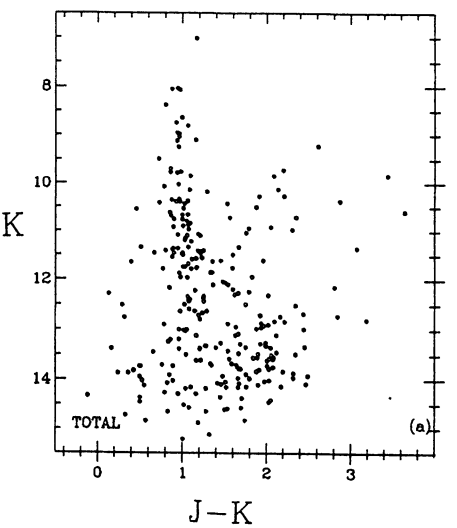

Fig. 2. (K, J-K) CMD of Westerlund 2.

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https://doi.org/10.1017/S0074180900056771 Published online by Cambridge University Press