The distance and reddening to IC 10 from preliminary JHK photometry

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Abstract. By comparing the brightest red supergiants in IC 10 and IC 1613, we derive for IC 10 that $E_{H-K} = 0.24 \pm 0.09$ mag (*i.e.*, $E_{B-V} = 1.26 \pm 0.19$ mag) and a true distance modulus 24.0 ± 0.13 mag.

1. Introduction

IC 10 is a Local Group starburst galaxy (Massey & Armandroff 1995). The recent estimates of distance and reddening to this galaxy differ significantly (Massey & Armandroff 1995; Wilson *et al.* 1996; Sakai *et al.* 1999). The main difficulty in this aspect is its line-of-sight proximity to the Galactic plane and variable internal reddening. In the infrared the effects due to the reddening are much less important. We present the deep JHK photometry of IC 10.

2. Observations and data reduction

The data discussed here were acquired with the infrared camera CAMILA attached to the 2.1-m telescope of the *Observatorio Astronomico National*, Mexico. A set of frames in the JHK filters was taken on January 11-13, 1998. The reduction to the standard system was made using twelve *UKIRT* standards. IRAF was used to carry out the standard reductions. The stellar photometry was done using DAOPHOT-II. We estimate our completeness limits to be 18.5 mag at J, 17.5 mag at H, and 17.0 mag at K.

3. Reddening and distance

The galaxy IC 1613 is another member of the Local Group. It has negligible reddening $E_{B-V} = 0.03$–0.06 mag, a true distance modulus 24.2 (Sandage 1971; Freedman 1988; Georgiev *et al.* 1999), and approximately the same metallicity as IC 10. We used its CMD as a reference reddening-free CMD. The two brightest stars on that diagram (Fig. 1) are the well known Red Variables V 32 and V 38 (Sandage 1971). After inspection of the distribution of foreground stars (Sakai *et*
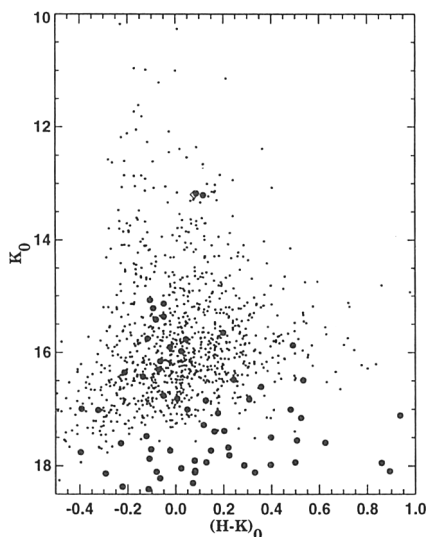
Figure 1. K_0 *vs.* $(H-K)_0$ diagrams for IC 10 (small dots) and IC 1613 (big dots).

al. 1999) we assumed that the few stars around $H-K = 0.35$ mag and $K = 14$ mag are of the same class of red variables and/or red supergiants. The expected mean variability in K for these stars is less than 0.1 mag. If this is the case, then the main difference between the IC 1613 Red Variables and those IC 10 stars is in the reddening. Based on those assumptions we derived $E_{H-K} = 0.24 \pm 0.09$ mag which corresponds to $E_{B-V} = 1.26 \pm 0.19$ mag, assuming $E_{H-K}/E_{B-V} = 0.19$. The best match between the two color-magnitude diagrams would imply that the true distance modulus to IC 10 is 24.0 ± 0.13.

References

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