



A revisit to the regions of some van den Bergh open clusters using photometric and astrometric parameters



R.B. Orellana^{a,b}, M.S. De Biasi^{a,b,*}, L.G. Paíz^a, I.H. Bustos Fierro^c, J.H. Calderón^c

^aFacultad de Ciencias Astronómicas y Geofísicas, UNLP, Paseo del Bosque s/n, 1900 La Plata, Argentina

^bInstituto de Astrofísica de La Plata (CCT La Plata – CONICET, UNLP), Argentina

^cObservatorio Astronómico, Laprida 854, 5000 Córdoba, Argentina

HIGHLIGHTS

- We determine astrometric parameter and stellar members of vdB80, vdB85 and vdB130.
- vdB80 and vdB85 astrometric parameters are determined for the first time using UCAC4.
- We find that proper motion errors do not significantly affect astrometric results.
- Astrometric members are compared with the photometric ones given in the literature.

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ABSTRACT

We present results of a study that combines photometry and astrometry for the open clusters vdB80, vdB85 and vdB130. We apply a model which analyses the proper motion distribution and the stellar density to find the kinematic parameters and stellar membership in the region of the mentioned open clusters. The astrometric data are obtained from UCAC4 catalogue. For each cluster, we report the centre coordinates, the components of mean proper motion, the angular diameter and the astrometric members. They are: vdB80: $\alpha = 97^\circ.73938 \pm 0^\circ.00846$, $\delta = -9^\circ.66953 \pm 0^\circ.01177$, $\mu_\alpha \cos \delta = -2.13 \pm 0.47$ mas/yr, $\mu_\delta = -0.95 \pm 0.47$ mas/yr, 12', 15 members; vdB85: $\alpha = 101^\circ.71670 \pm 0^\circ.00808$, $\delta = 1^\circ.34392 \pm 0^\circ.01253$, $\mu_\alpha \cos \delta = 0.89 \pm 0.43$ mas/yr, $\mu_\delta = 3.24 \pm 0.43$ mas/yr, 8', 9 members; vdB130: $\alpha = 304^\circ.44001 \pm 0^\circ.01407$, $\delta = 39^\circ.32745 \pm 0^\circ.00726$, $\mu_\alpha \cos \delta = -4.14 \pm 0.25$ mas/yr, $\mu_\delta = -5.15 \pm 0.25$ mas/yr, 9', 9 members. We analyse the incidence of the proper motion errors in the determination of the cluster parameters and of the stellar membership and find that they are not significantly changed. We finally compare the astrometric members with the photometric ones given in the literature.

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1. Introduction

In 1966 van den Bergh publishes a catalog of 158 reflection nebulae and remarks that several of them contain open clusters named as the reflection nebula to which they are associated. The knowledge of these embedded clusters let study the very initial phases of star formation (Bica et al., 2003).

Some of these clusters have been investigated using photometric techniques in order to determine the member stars, consequently the cluster fundamental parameters, e.g. distances, masses, ages,

metallicity, mean radial velocity can be derived. An accurate knowledge of their members is therefore crucial.

Due to the fact that open cluster members share similar photometric and kinematic properties, it is worth to complete the study of the stars of the clusters field by employing astrometric methods. This analysis contributes to remove the contamination effect arised from a photometric membership determination, as Corti and Orellana (2013) demonstrate it in their investigations on the open cluster NGC 4755 and the stellar association CenOB1.

In this work we present improvements of the membership probability of the stars in the regions of the open clusters vdB80, vdB85 and vdB130, whose photometric members are given in the literature.

Open cluster vdB80: has equatorial coordinates $\alpha = 6^{\text{h}}30^{\text{m}}50^{\text{s}}$ and $\delta = -9^\circ 39' 18''$ ($l = 219^\circ.26$, $b = -8^\circ.93$) and is placed in Monoceros. It was first identified by van den Bergh (1966) and

* Corresponding author at: Facultad de Ciencias Astronómicas y Geofísicas, UNLP, Paseo del Bosque s/n, 1900 La Plata, Argentina.

E-mail addresses: rorellan@fcaglp.unlp.edu.ar (R.B. Orellana), debiasi@fcaglp.unlp.edu.ar (M.S. De Biasi), lpaiz@fcaglp.fcaglp.unlp.edu.ar (L.G. Paíz), ivanbf@oac.uncor.edu (I.H. Bustos Fierro), calderon@oac.uncor.edu (J.H. Calderón).

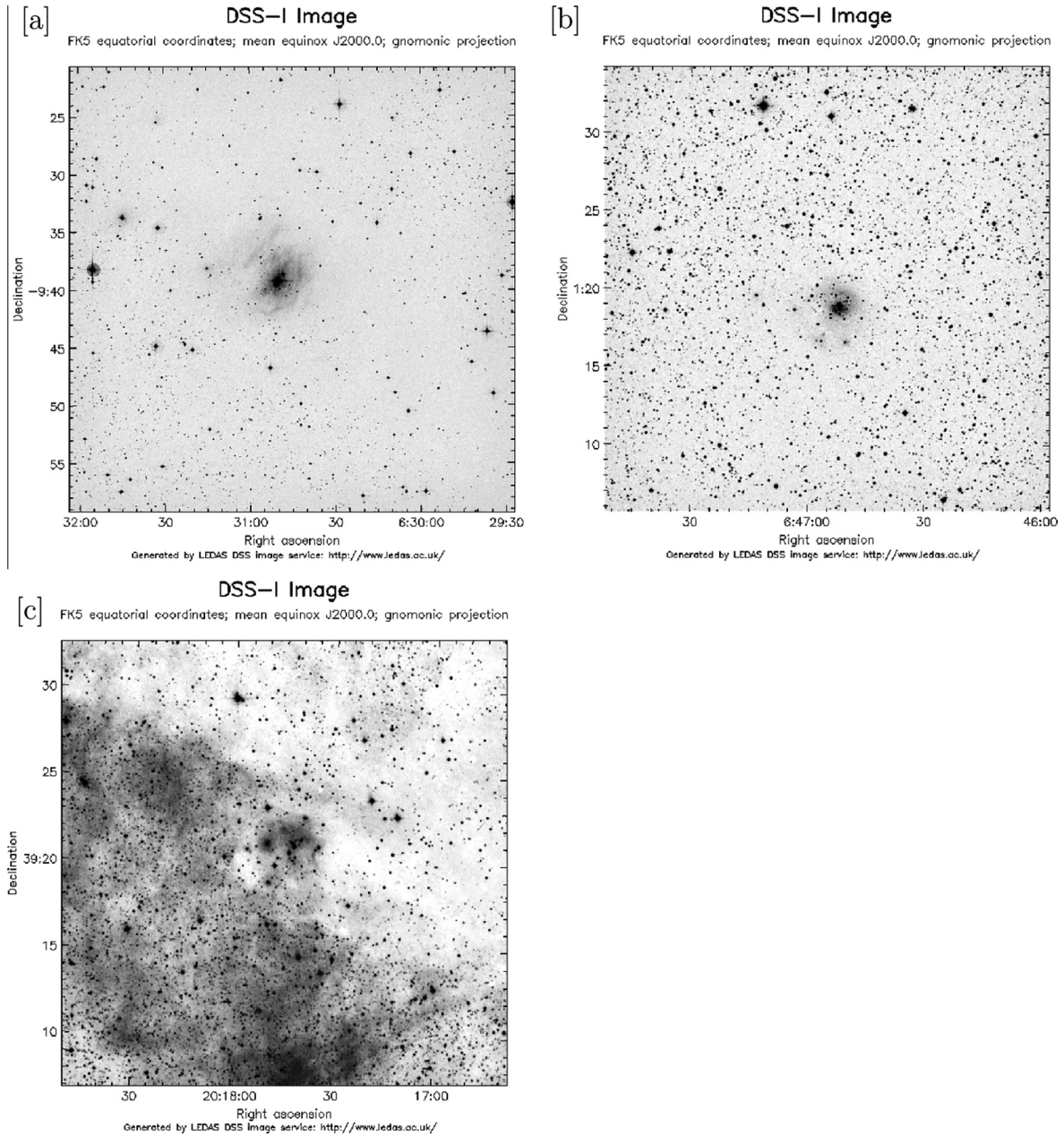


Fig. 1. Images of the optical environments of open clusters vdB80 (a), vdB85 (b), vdB130 (c). Right ascension and declination are given in the abscissa and ordinate, respectively. Orientation: north to the top and east to the left.

contains the stars BD −9 1498 (HD 46060) and BD −9 1497. Racine (1968) performed photometry and spectroscopy for 80a (HD 46060) and photometry for 80b (BD −9 1497) y 80c. In 1972 Aveni and Hunter (1972) study this compact cluster and determined spectral type and photometric data for a 24-star sample. They found seven possible members considering their spectroscopic distances and estimated the cluster age in 10^6 yr. Ahumada et al. (2001) estimate its age in $4.5 \pm 1.5 \times 10^6$ yr by an integrated spectrum indicating that it is a very young cluster. A more extensive analysis using 2MASS data is done by Bonatto and Bica (2009). They identify the members up magnitude 16 from a colour-magnitude diagram where a poorly populated main sequence and many pre-MS stars are displayed. In addition, they determine the cluster age of 5 ± 2 Myr, a distance of 2.1 ± 0.3 kpc, a mass of $95 \pm 17 M_{\odot}$ and the analysis of the stellar density profile gives the value of $0.46 \pm 0.08'$ for core and of $5.8 \pm 0.3'$ for the cluster.

Open cluster vdB85: discovered in 1966 by van den Bergh, its placed in Monoceros. Its equatorial coordinates are $\alpha = 06^{\text{h}}46^{\text{m}}54^{\text{s}}$ and $\delta = +01^{\circ}20'00''$ ($l = 211^{\circ}.2280$, $b = -00^{\circ}.4014$) and it includes the star BD + 1 1503 (HD289120). Racine (1968) makes photometric and spectroscopic observations of this star. The reflection nebula vdB-RN85 is also named as NGC 2282 in the literature. The first detailed near-infrared (JHK) imaging and photometry of the young open cluster associated to NGC 2282 is conducted by Horner et al. (1997). They investigate fundamental parameters of the cluster and the surrounding region, identify about 100 cluster members and locate the cluster at 1.7 kpc.

Open cluster vdB130: is situated in Cygnus and their coordinates are $\alpha = 20^{\text{h}}17^{\text{m}}42^{\text{s}}$ and $\delta = +39^{\circ}21'00''$ ($l = 76^{\circ}.9083$, $b = +02^{\circ}.0721$). It is first identified by van den Bergh in 1966 including the star BD + 38 3993 (HD228789). In 1968, Racine identifies two stars as cluster members and carries out photometric and spectroscopic observations, being HD228789 one of these

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