

Breaking the curtain: the old open cluster VdB-Hagen 67 in the background of the Vela Molecular Ridge

Giovanni Carraro¹*† and Edgardo Costa²†

¹*European Southern Observatory, Alonso de Cordova 3107, Casilla 19001, Santiago 19, Chile*

²*Departamento de Astronomía, Universidad de Chile, Casilla 36-D, Santiago, Chile*

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ABSTRACT

We present optical and infrared photometry for VdB-Hagen 67, an overlooked old open cluster located at $l = 273^{\circ}76$, $b = -0^{\circ}375$ (RA $09^{\text{h}}26^{\text{m}}45^{\text{s}}$, Dec. $-51^{\circ}16'00''$, J2000.0) in the fourth Galactic quadrant, in the direction of the Vela Molecular Ridge. VdB-Hagen 67 is immersed in a dense stellar field which is characterized by highly patchy extinction, and A_V in the line of sight to the cluster is larger than 3 mag. The cluster looks symmetric and it clearly stands out from the general Galactic field. By means of a star count analysis, both in the optical and IR, we have estimated that its radius is of about 2 arcmin. Before this study, only very general information was available for this cluster, but here we have determined its fundamental parameters. The age of VdB-Hagen 67 has been estimated, both empirically and with theoretical isochrones, and turns out to be about 1.3 Gyr. The difficulty to separate cluster members from interlopers prevented us from estimating its metallicity. No traces of subgiant or red-giant branch stars are visible in its field-star-decontaminated colour–magnitude diagrams; VdB-Hagen 67 is an old, poorly populated, star cluster on the verge of dissolving into the general Galactic field. We derive a heliocentric distance of ~ 7.5 kpc and a galactocentric distance of ~ 11.5 kpc. With the exception of FSR 1415 at 8.6 kpc, and with an age of ~ 2.5 Gyr, no other old clusters are known so far from the Sun in this Galactic sector. We argue that in this region of the Galactic plane several other distant clusters of this age have to exist, but have not been unravelled mainly because of the significant extinction produced by the dense Vela Molecular Ridge.

Key words: Galaxy: disc – open clusters and associations: general – open clusters and associations: individual: VdB-Hagen 67 – Galaxy: structure.

1 INTRODUCTION

The Vela Molecular Ridge is a conspicuous system of four major Giant Molecular Clouds – and several smaller dark clouds and globules – located at distances between 0.5 and 2.5 kpc from the Sun, in the sector $l \sim 255^{\circ}–280^{\circ}/-5^{\circ} \leq b \leq +5^{\circ}$ of the Galactic plane (Murphy & May 1991; May, Alvarez & Bronfman 1997). It is believed that this molecular complex is part of a spiral arm, but its real nature is not clear; it could be a part of the Orion arm extension into the third Galactic quadrant, or an interarm feature connecting the Orion arm to the Sagittarius arm.

The presence of the Vela Ridge has prevented, for many years, a detailed optical study of the outer spiral structure in this Galactic sector. The vast majority of optical star clusters detected in this region (both young and old) lie close to the Sun (Moffat & Vogt

1973; Vogt & Moffat 1975), where most of the absorption occurs (Burstein & Heiles 1984). More recently, and as a result of the Two Micron All Sky Survey (2MASS; Skrutskie et al. 2006), the census of candidate embedded clusters in this region has increased significantly (Bica, Dutra & Barbuy 2003; Froebrich, Scholz & Raftery 2007; Kopusov, Glushkova & Zolotukhin 2008), but so far the basic properties (distance, age, etc.) of most of these clusters remain undetermined.

Most of these candidate clusters are probably nearby young clusters, embedded in the molecular cloud complex. Examination of modern star cluster catalogues (see, e.g., Dias et al. 2002) reveals that no clusters older than 200–300 Myr have been detected so far, at distances larger than 1 kpc from the Sun, in this part of the Galactic disc. A notable exception is that of the old (2.5 Gyr) open cluster FSR 1415 (Momany et al. 2008), which lies at a heliocentric distance of 8.6 kpc ($l \sim 264^{\circ}$, $b \sim -2^{\circ}$). It should be noted that this cluster was detected via high-spatial resolution infrared (IR) observations carried out using the Multi-Conjugate Adaptive Optics Demonstrator at the Very Large Telescope.

*On leave from Dipartimento di Astronomia, Università di Padova, Italy.
†E-mail: gcarraro@eso.org (GC); costa@das.uchile.cl (EC)

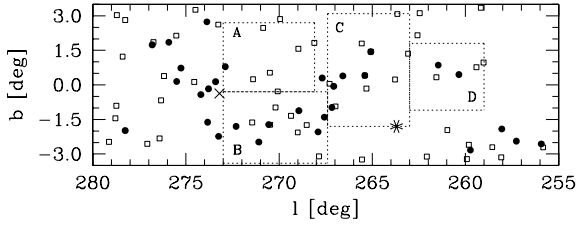


Figure 1. Field in the direction of the Vela Molecular Ridge. VdB-Hagen 67 is indicated with a cross. Open and filled symbols are dark nebulae and globules, respectively. The four major Vela molecular clouds (A, B, C and D) are depicted with dashed lines. The position of the open cluster FS1415 is indicated with an asterisk.

In this paper, we provide evidence for another distant old open cluster located in the direction of the Vela ridge: Vdb-Hagen 67. This cluster was discovered by van den Bergh & Hagen (1976), and is described by the authors as a moderately populated cluster, with a diameter of ~ 4 arcmin, but its classification is considered uncertain. The fact that this cluster is visible only in red plates is what attracted our attention to it, since it could be a (possibly) very reddened, young, distant cluster, and therefore a potentially interesting target for our optical survey of the spiral structure in the outer disc (Moitinho et al. 2006; Vázquez et al. 2008; Carraro & Costa 2009). Optical colours in fact permit a more robust determination of fundamental parameters for young – even significantly reddened – star clusters. Additionally, to the best of our knowledge, a detailed study of this cluster has never been carried out so far.

This paper is organized as follows. In Section 2, we collect all the available information on Vdb-Hagen 67 from the literature and discuss its location in the disc. Section 3 deals with the data we collected and the method we used to reduce it. Star counts are then performed in Section 4, while in Section 5 we estimate the basic parameters of the cluster. The most important conclusion are finally summarized in Section 6.

2 THE STAR CLUSTER VDB-HAGEN 67 AND ITS SURROUNDINGS

VdB-Hagen 67 is located in the fourth Galactic quadrant, at $l = 273.76$, $b = -0.375$ (RA $09^{\text{h}} 26^{\text{m}} 45^{\text{s}}$, Dec. $-51^{\circ} 16' 00''$, J2000.0), in a crowded region shown in Fig. 1. In this figure, the four major molecular clouds (A, B, C and D) of the Vela Molecular Ridge are depicted with dashed lines (from Murphy & May 1991), and dark nebulae and globules with open and filled symbols (from Feitzinger & Stüwe 1984), respectively. The asterisk indicates the position of FS1415 (Momany et al. 2008), and the cross that of VdB-Hagen 67.

As can be seen in Fig. 2, made from a 1200 s I -band exposure, VdB-Hagen 67 lies very close to the dark globule SRC 65-212 (Feitzinger & Stüwe 1984): the cluster is the concentration of stars close to the image centre, while the dark globule is located to the north-east. The field shown in Fig. 2 is 20 arcmin on a side; north is up, and the east to the left.

3 OBSERVATIONS AND DATA REDUCTION

3.1 Observations

The region of interest (see Fig. 2) was observed with the Y4KCAM camera attached to the Cerro Tololo Inter-American Observatory

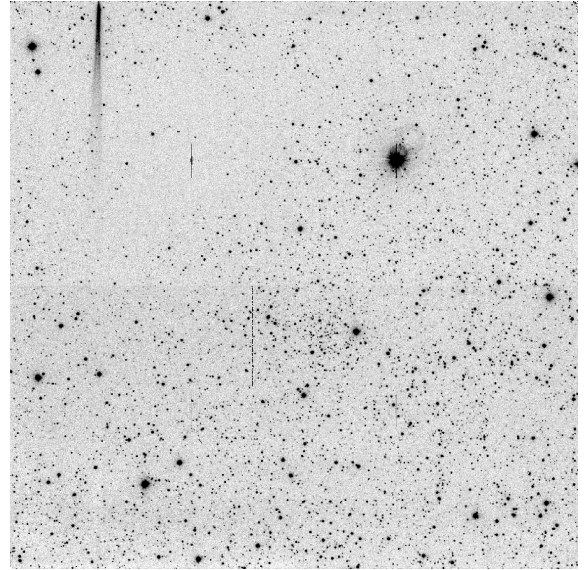


Figure 2. I band 1200 s image centred on VdB-Hagen 67. The field is 20 arcmin on a side; north is up, and east to the left. The cluster is the concentration of stars close to the image centre, and the dark globule located to the north-east is SRC 65-212.

(CTIO) 1.0-m telescope, operated by the SMARTS consortium.¹ This camera is equipped with an STA 4064×4064 CCD with $15\text{-}\mu$ pixels, yielding a scale of 0.289 arcsec pixel $^{-1}$ and a field of view (FOV) of 20×20 arcmin 2 at the Cassegrain focus of the CTIO 1.0-m telescope. The CCD was operated without binning, at a nominal gain of 1.44 e $^{-}$ /ADU (analog to digital unit), implying a readout noise of 7 e $^{-}$ per quadrant (this detector is read by means of four different amplifiers). Quantum efficiency and other detector characteristics can be found at <http://www.astronomy.ohio-state.edu/Y4KCam/detector.html>.

In Table 1, we present the log of $BVRI$ observations. All observations were carried out in photometric, and sub-arcsec seeing conditions. Our $BVRI$ instrumental photometric system was defined by the use of a standard broad-band Kitt Peak $BVR_{kc}I_{kc}$ set. Transmission curves for these filters can be found at <http://www.astronomy.ohio-state.edu/Y4KCam/filters.html>. To determine the transformation from our instrumental system to the standard Johnson–Kron–Cousins system, and to correct for extinction, we observed 46 stars in area SA 98 (Landolt 1992) multiple times, and with different airmasses ranging from ~ 1.1 to ~ 2.6 . Field SA 98 is very advantageous, as it includes a large number of well-observed standard stars, and it is completely covered by the CCD’s FOV. Furthermore, the standard’s colour coverage is very good, being $-0.2 \leq (B - V) \leq 2.2$ and $-0.1 \leq (V - I) \leq 6.0$.

3.2 Reductions

Basic calibration of the CCD frames was done using the Yale/SMARTS y4k reduction script based on the IRAF² package CCDRED. For this purpose, zero exposure frames and twilight sky flats were taken every night. Photometry was then performed using the IRAF, DAOPHOT and PHOTCAL packages. Instrumental magnitudes were

¹<http://http://www.astro.yale.edu/smarts>

²IRAF is distributed by the National Optical Astronomy Observatory, which is operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1. Log of *BVRI* photometric observations.

Target	Date	Filter	Exposure (s)	Airmass
VdB-Hagen 67	2008 January 29	<i>V</i>	5, 10, 60, 120	1.08–1.09
		<i>R</i>	5, 10, 60, 120	1.08–1.08
SA 98	2008 January 29	<i>B</i>	2 × 10, 200, 300, 400	1.17–1.96
		<i>V</i>	2 × 10, 100, 2 × 200	1.24–2.32
		<i>R</i>	2 × 30, 120, 1200	1.20–2.22
		<i>I</i>	2 × 10, 50, 100, 2 × 150	1.19–2.13
VdB-Hagen 67	2008 January 30	<i>B</i>	5, 10, 20, 100, 200	1.19–1.20
		<i>I</i>	5, 10, 60, 120	1.22–1.23
SA 98	2008 January 30	<i>B</i>	2 × 10, 200, 300, 400	1.15–2.36
		<i>V</i>	2 × 10, 100, 2 × 200	1.16–2.53
		<i>R</i>	2 × 30, 120, 1200	1.17–2.61
		<i>I</i>	2 × 10, 50, 100, 2 × 150	1.16–2.46
VdB-Hagen 67	2008 February 3	<i>B</i>	30, 1500	1.08–1.08
		<i>V</i>	30, 120, 1200	1.08–1.08
		<i>R</i>	2 × 30, 120, 1200	1.15–1.16
		<i>I</i>	30, 1200	1.07–1.07
SA 98	2008 February 3	<i>B</i>	2 × 10, 200, 300, 400	1.15–2.40
		<i>V</i>	2 × 10, 100, 2 × 200	1.17–1.89
		<i>R</i>	2 × 30, 120, 1200	1.15–2.01
		<i>I</i>	2 × 10, 50, 100, 2 × 150	1.16–2.62

extracted following the point spread function (PSF) method (Stetson 1987). A quadratic, spatially variable, Master PSF (PENNY function) was adopted. Aperture corrections were determined making aperture photometry of a suitable number (typically 10–20) of bright, isolated stars in the field. These corrections were found to vary from 0.160 to 0.290 mag, depending on the filter. The PSF photometry was finally aperture-corrected, filter by filter.

3.3 The photometry

After removing problematic stars, and stars having only a few observations in Landolt’s (1992) catalogue, our photometric solution for a grand total of 314 measurements per filter – obtained by combining standard star observations from all nights – turned out to be

$$B = b + (2.103 \pm 0.012) + (0.27 \pm 0.01) \times X - (0.101 \pm 0.007) \times (B - V)$$

$$V = v + (1.760 \pm 0.007) + (0.15 \pm 0.01) \times X + (0.028 \pm 0.007) \times (B - V)$$

$$R = r + (1.850 \pm 0.010) + (0.11 \pm 0.01) \times X - (0.040 \pm 0.006) \times (V - R)$$

$$I = i + (2.751 \pm 0.011) + (0.08 \pm 0.01) \times X + (0.045 \pm 0.008) \times (V - I)$$

The final rms of the fitting were 0.060, 0.035, 0.030 and 0.030 in *B*, *V*, *R* and *I*, respectively.

Global photometric errors were estimated using the scheme developed by Patat & Carraro (2001, appendix A1), which takes into account the errors resulting from the PSF fitting procedure (i.e. from ALLSTAR) and the calibration errors (corresponding to the zero point, colour terms and extinction errors). In Fig. 3, we present global photometric error trends plotted as a function of *V* magnitude. Quick inspection shows that stars brighter than $V \approx 20$ mag have errors lower than 0.05 mag in magnitude and lower than 0.10 mag in all colours.

Our final optical photometric catalogue consists of 9260 entries having *BVRI* measures down to $V \sim 20$, and 13493 entries having *VI* measures down to $V \sim 22$.

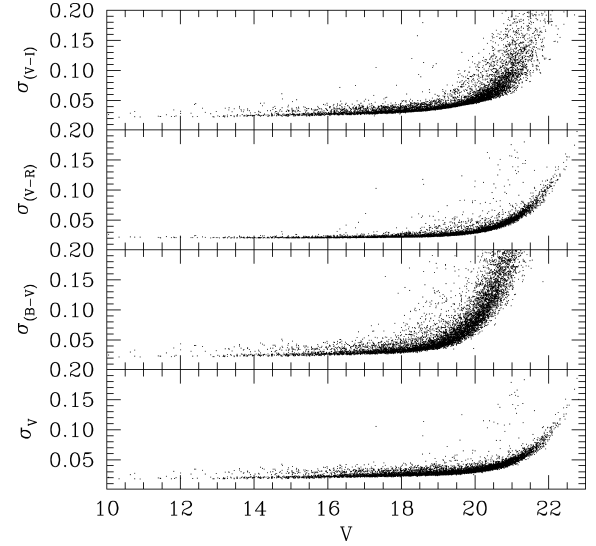


Figure 3. Photometric errors in *V*, (*B* – *V*), (*V* – *R*) and (*V* – *I*) as a function of *V* magnitude.

3.4 Complementary infrared data, astrometry and completeness

Our optical catalogue was cross-correlated with 2MASS (Skrutskie et al. 2006), which resulted in a final catalogue including *BVRI* and *JHK_s* magnitudes. As a by-product, pixel (detector) coordinates were converted to RA and Dec. for J2000.0 equinox, thus providing 2MASS-based astrometry.

Finally, completeness corrections were determined by running artificial star experiments on the data. Basically, we created several artificial images by adding artificial stars to the original frames. These stars were added at random positions, and had the same colour and luminosity distribution of the true sample. To avoid generating overcrowding, in each experiment we added up to 20 per cent of the original number of stars. Depending on the frame, between 1000 and 5000 stars were added. In this way, we have

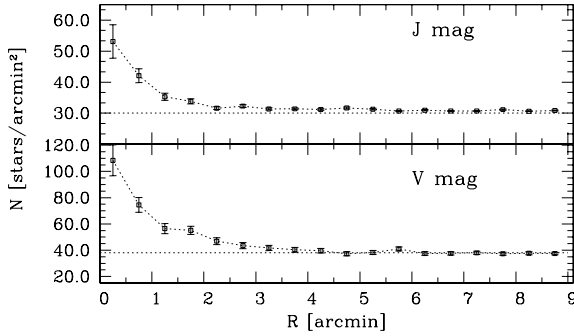


Figure 4. Optical (V) and IR (J) star counts in the area of VdB-Hagen 67. The dashed lines indicate the mean star density of the field.

estimated that the completeness level of our photometry is better than 50 per cent down to $V = 20.5$.

4 STAR COUNTS AND CLUSTER SIZE

We used star counts to assess the reality of the cluster and estimate its size. In such a complex region, a random variation of interstellar reddening can in fact create a false cluster. Star counts, in combination with colour–magnitude diagrams (CMDs) can help to distinguish a physical cluster from a chance overdensity.

Fig. 2 shows that VdB-Hagen 67 is compact and spherical. Its centre was determined by inspecting this figure and chosen at the location of star #2158, which has RA $141^{\circ}96$ and Dec. $-51^{\circ}29$. Star counts were then performed by counting the number of stars having $17 \leq V \leq 23$ in concentric rings, 0.5 arcmin wide, centred on the cluster, and dividing by each ring area. The distance from the cluster’s centre at which star counts cease to increase corresponds to the mean star density of the field, and gives us an estimate of the cluster’s radius. By means of this procedure, we can identify as many cluster members as possible, limiting at the same time the contamination by field stars.

To highlight absorption effects we first used V -band data, and then repeated the procedure for the J band. The results are shown in Fig. 4, where the dashed lines indicate the mean star density of the field. Examining this figure, we can conclude that:

- (i) the optical and IR profile look similar, and the cluster clearly stands up above the general field;
- (ii) in both the cases, the radius of the cluster is located at ~ 2.0 arcmin, confirming the results of van den Bergh & Hagen (1976) based on visual inspection of red plates. This estimate also agrees with the value given by Dias et al. (2002).

5 BASIC PARAMETERS OF VDB-HAGEN 67

In this section, we will make use of the results presented above (together with complementary statistical techniques) to isolate cluster members, in order to confirm the physical nature of VdB-Hagen 67, determine its basic parameters and distinguish age and distance dependent features in its CMD.

5.1 Colour–magnitude diagrams

In Fig. 5, we present optical CMDs (left-hand panels), for three different colour combinations, based on all measured stars having errors lower than 0.05 mag: V versus $(B - V)$, V versus $(V - R)$ and V versus $(V - I)$; together with the corresponding K_s versus $(J - K)$ IR CMD based on 2MASS data (right-hand panel).

These CMDs are clearly dominated by dwarf [the conspicuous main sequence (MS)] and giant stars from the thin disc, located at different distances, and affected by different amounts of extinction. According to Schlegel, Finkbeiner & Davis (1998), reddening in the line of sight (integrated to infinity) is $E(B - V) = 0.95$, which implies $A_V = 3.0$. Given that the absorption towards VdB-Hagen 67 occurs almost entirely within 1 kpc from the Sun due to the Vela Molecular Ridge (Burstein & Heiles 1984; Amores & Lépine 2005; Vázquez et al. 2008), this latter value can be considered a good estimate of the cluster’s reddening.

Although the cluster is clearly visible in Figs 2 and 4, none of these CMDs shows clear evidence for its existence.

To dig it out, we make use of the results of previous section and consider only the stars within 1.5 arcmin from the cluster centre.

The results are shown in the CMDs presented in Figs 6–8, for V versus $(B - V)$, V versus $(V - I)$ and K_s versus $(J - K)$, respectively. In these figures, stars located within 1.5 arcmin from the cluster’s centre are depicted by large solid circles. Inspection of

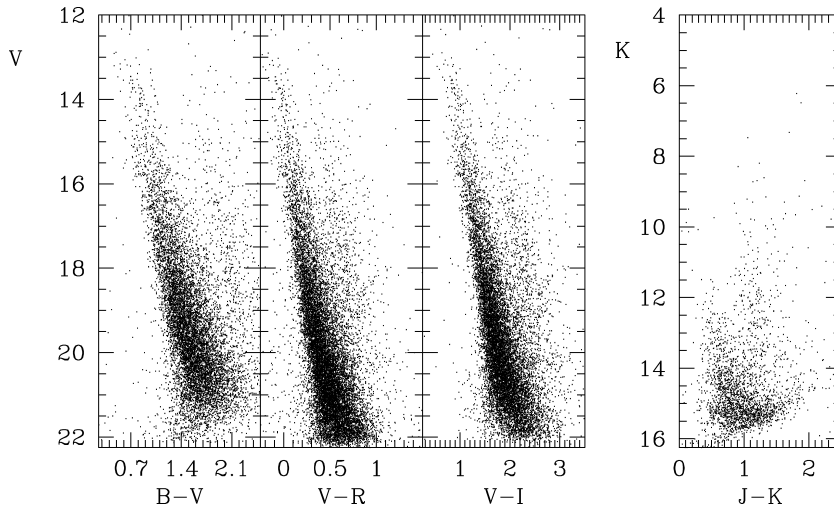


Figure 5. Optical CMDs (left-hand panels) for three different colour combinations, based on all measured stars having errors lower than 0.05 mag, together with the corresponding IR CMD based on 2MASS data (right-hand panel).

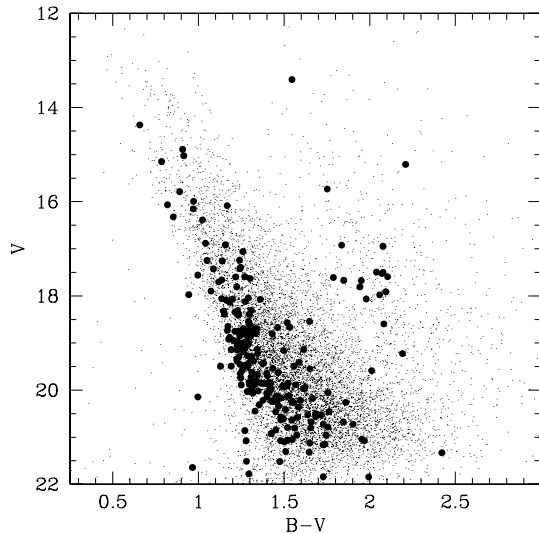


Figure 6. Selection of member based on distance from the cluster centres. Filled circles indicate stars within 1.5 arcmin from the centre.

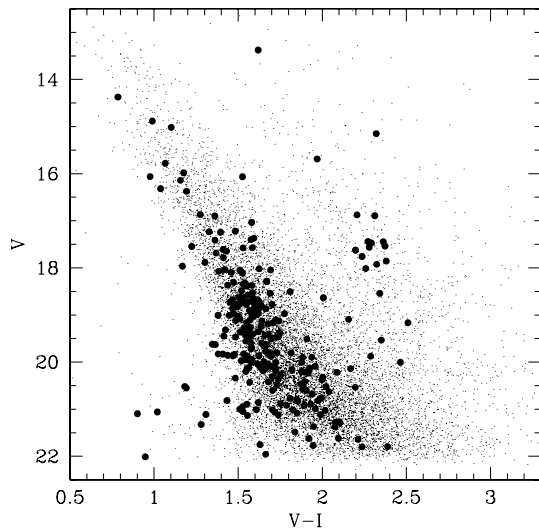


Figure 7. Selection of member based on distance from the cluster centres. Filled circles indicate stars within 1.5 arcmin from the centre.

these figures shows that the cluster actually exists, although quite contaminated by field stars, even in such a small area.

In spite of the serious contamination by field stars, the V versus $(B - V)$ CMD (Fig. 6) shows a clear MS, with a turn-off point (TO) at $V \sim 19$, $(B - V) \sim 1.2$, and a clump of red stars at $V \sim 18$, $(B - V) \sim 2.1$. This group of red stars is what made possible the detection of the cluster on red maps. There is no trace of a red-giant branch (RGB), which limits the cluster's age to a maximum of 2 Gyr (Cannon 1970). These same features can be distinguished in both the V versus $(V - I)$ CMD (Fig. 7) and K_s versus $(J - K)$ CMD (Fig. 8). In the V versus $(V - I)$ CMD, the TO and clump are located at $(V - I) \sim 1.5$ and 2.3, respectively, while in the K_s versus $(J - K)$ CMD we recognize the clump at $K \sim 12.3$, $(J - K) \sim 1.2$ and the TO (significantly blurred) at $K \sim 14.5$, $(J - K) \sim 0.5$.

All these CMDs confirm that VdB-Hagen 67 is indeed a faint, old open cluster. The morphology of the CMDs resembles old open clusters like NGC 2660 (Sandrelli et al. 1999) and NGC 1883 (Carraro, Baume & Villanova 2003).

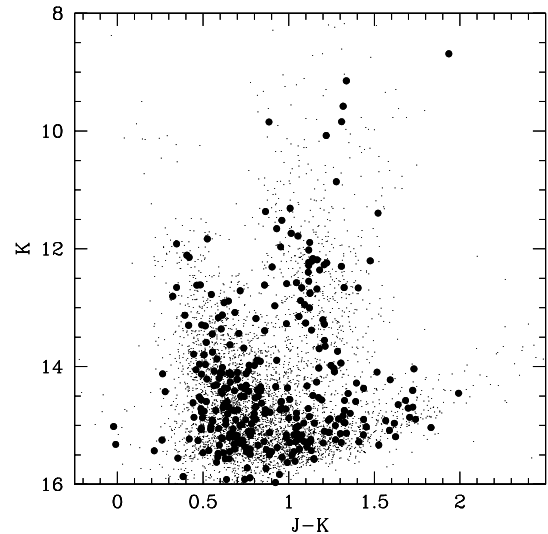


Figure 8. Selection of member based on distance from the cluster centres. Filled circles indicate stars within 1.5 arcmin from the centre.

5.2 Field star decontamination

With the aim of confirming the physical nature of VdB-Hagen 67, and to determine its basic parameters, we performed a statistical subtraction of field stars using three different comparison fields. Because the field around VdB-Hagen 67 is highly inhomogeneous, we expect to see important differences in the field of star-decontaminated CMD, depending on the comparison field used.

The technique is simple and widely used, and the details are described in Carraro & Costa (2007) or Baume et al. (2007). Briefly, for any given star in the comparison field region we look for the most similar star (in colour and magnitude) in the cluster region, and remove it from the CMD of the cluster. It should be noted that the procedure takes into account differences in the completeness levels of the cluster and field CMDs. For this purpose, we selected three comparison fields, which we call Field 1 (centred at $X = 500$, $Y = 3500$, south-east of the cluster), Field 2 (centred at $X = 3500$, $Y = 500$, south-west of the cluster) and Field 3 (centred at $X = 3500$, $Y = 3500$, north-west of the cluster). They were chosen at adequate distances from the cluster centre, in order to avoid the presence of cluster stars, and away from the dark globule SRC 65-212 to the north-east of the cluster. These fields have the same area as the cluster area (circles with radius of 2 arcmin).

The results are shown in Fig. 9. The three upper panels show the CMDs of the reference fields, whereas the middle and lower panels show the CMDs of the subtracted stars and the CMDs of the 'clean' cluster, respectively. As anticipated above, the three clean CMDs look quite different, and only in one case (Field 2) the TO of the cluster clearly stands out. In the other two cases, some contamination from interlopers still remains and blurs the TO region. Nevertheless, in all the three cases the broad clump of red giants is still present, indicating that it is a real feature of the cluster.

5.3 Age, reddening and distance. Empirical estimates

By means of the clean cluster CMD derived from Field 2, together with the IR CMD, we can empirically infer preliminary estimates of age, distance and reddening.

The cluster's age can be constrained using the magnitude difference between the clump of red stars and the TO, both in the

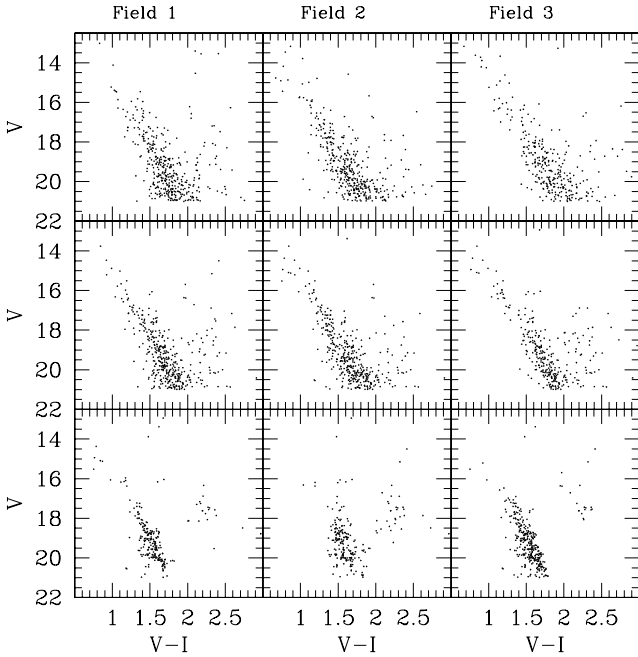


Figure 9. Field star decontamination procedure. The upper panel shows the CMDs of three different comparison fields. The middle panel shows the corresponding CMDs of the stars subtracted, as described in the text. In the lower panel, the corresponding clean cluster CMDs are shown.

optical and in the IR. These differences are named ΔV and ΔK , and are well known to be age indicators independent of distance. The optical parameter has some dependence on metallicity (Carraro & Chiosi 1994), but the IR parameter is almost metallicity independent (Beletsky, Carraro & Ivanov 2009). In the optical CMD, the clump is located at $V = 18.0$ and the TO at $V = 19.2$, giving $\Delta V = 1.2 \pm 0.2$, which in turn means an age of about 1.3 ± 0.3 Gyr (Carraro & Chiosi 1994, equation 3). In the infrared CMD, the difference ΔK is 2.3 ± 0.3 (see Section 5.1), implying an age of 1.2 ± 0.3 Gyr according to the recent calibration of Beletsky et al. (2009, equation 2). It should be noted that the two estimations provide consistent results.

As mentioned in Section 5.1, the Schlegel reddening in the line of sight is $E(B - V) \sim 0.95$. If, for the moment, we adopt this value for $E(B - V)$, we can obtain a rough estimate of the cluster’s distance using the mean visual absolute magnitude of the clump ($M_V = 0.80$, Girardi et al. 1998), which is well known to have some dependence on age and metallicity (Girardi et al. 1998). For VdB-Hagen 67 the clump is located at $V = 18$, which gives an absolute distance modulus of $(m - M)_o = 14.2$, therefore a distance of 7.1 kpc from the Sun.

5.4 Metal abundance. Comparison with theoretical models

To obtain an estimate of the cluster’s metal abundance, we have fitted isochrones from the Padova suite of stellar models (Girardi et al. 2000), to a ‘clean’ V versus $(B - V)$ CMD of VdB-Hagen 67; as shown in Fig. 10, where two isochrones, for two different metallicities: $Z = 0.020$ (dashed red line) and $Z = 0.008$ (dotted blue line) have been overlaid. From these two isochrone fittings we have obtained the basic parameters listed in Table 2.

As can be seen in Fig. 10, the two isochrones drawn – corresponding to reasonably different values of Z – adjust with comparable accuracy the star distribution in the CMD; indicating that with the

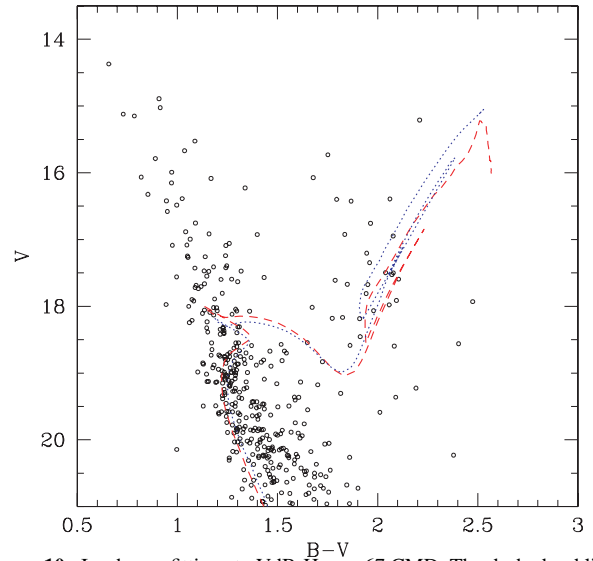


Figure 10. Isochrone fittings to VdB-Hagen 67 CMD. The dashed red line is for $Z = 0.020$, while the dotted blue line is for $Z = 0.008$. The parameters adopted to adjust the isochrones shown are listed in Table 2.

Table 2. Basic parameters of VdB-Hagen 67 from two isochrone fittings.

Z	$E(B - V)$ (mag)	$m - M$ (mag)	d_{\odot} (kpc)	Age (Gyr)
0.020	0.95 ± 0.05	17.3 ± 0.1	7.4 ± 0.6	1.2
0.008	1.05 ± 0.05	17.5 ± 0.1	7.1 ± 0.6	1.3

data available we cannot discriminate between different plausible metallicities. The parameters we adopted to adjust the isochrones are in agreement within the uncertainties (which have been estimated by eye). This drawback can be explained by the scarcity of stars in the cluster and the severe contamination by field stars.

We therefore conclude that the comparison with stellar models basically yields the same results we obtained in an empirical way.

6 CONCLUSIONS

We have presented optical and IR photometry for VdB-Hagen 67, an open star cluster which lies in the direction close to the border of the Vela Molecular Ridge. VdB-Hagen 67 was detected by its population of bright red clump stars, and before this study only very general information about it was available. The cluster looks symmetric and it clearly stands out from the general Galactic field. By means of a star count analysis, both in the optical and IR, we have estimated that its radius of about 2 arcmin.

The age of VdB-Hagen 67 has been estimated, both empirically and with theoretical isochrones, and turns out to be about 1.3 Gyr. For this age, we derive a reddening of $E(B - V) \sim 0.95$ (implying $A_V \approx 3.0$), a heliocentric distance of almost 8 kpc and (adopting 8.5 kpc as distance of the Sun to the Galactic centre), a Galactocentric distance of 11.5 kpc.

No traces of subgiant or RGB stars are visible in its field-star-decontaminated CMDs. VdB-Hagen 67 is an old, poorly populated, star cluster on the verge of dissolving into the general Galactic field. With the exception of FSR 1415 at 8.6 kpc, no other old clusters are known so far from the Sun in this Galactic sector, mainly because of the significant extinction produced by the dense Vela Molecular

Ridge. We argue that in this region of the Galactic plane several other distant clusters of this age have to exist, and will be unravelled by next generation visible/IR surveys like the Visible and Infrared Survey Telescope for Astronomy (VISTA; McPherson et al. 2004; Ivanov 2009).

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