

STUDY OF YOUNG STELLAR CLUSTERS IN THE NEBULAR COMPLEX NGC6357 WITH VVV¹

E. F. Lima², E. Bica², C. Bonatto², and R. K. Saito³

In this work we study the nature of a series of star clusters embedded or projected towards the complex of HII regions and molecular clouds NGC 6357.

NGC 6357 (\equiv W 22 \equiv RCW 131 \equiv Sh2–11) is a large HII region complex that consists of a shell of about 60×40 arcmin², bright optical nebulosities in different evolutionary stages, OB stars belonging to the massive open cluster Pismis 24 and young stellar object (YSO) candidates (Russeil et al. 2010, Cappa et al 2011).

A range of distances (1.1 – 2.6 kpc) has been derived for NGC 6357. This is usually estimated from the distance of Pismis 24. Its most recent determination is 1.7 ± 0.2 kpc (Fang et al. 2012).

To disentangle field and cluster stars we use a statistical decontamination algorithm described in detail in Bonatto & Bica (2007) and adapted to the photometric depth of VVV. To replace VVV saturated stars we used 2MASS photometry. Fundamental parameters are derived by means of the constraints provided by the field-decontaminated colour-magnitude diagram (CMD) morphologies combining the MS and PMS star distributions (e.g. Fig. 1). Historically, different approaches have been used to extract astrophysical parameters from isochrone fits. In this work fits are made *by eye*, taking the combined MS and PMS stellar distribution as constraint. We work with PARSEC isochrones⁴ (solar metallicity) computed with the VISTA Z, Y, J, H and K_S filters to derive the fundamental parameters.

From the clusters belonging to the complex we derived a mean distance of $d_{\odot} = 1.76 \pm 0.1$ kpc.

We conclude that NGC 6357 has had at least two stellar generation events, within the range of 5 to 9 Myr. This age difference may help to understand the star forming history of the complex.

We use projected stellar RDPs, i.e. the stellar number density around the cluster center, to de-

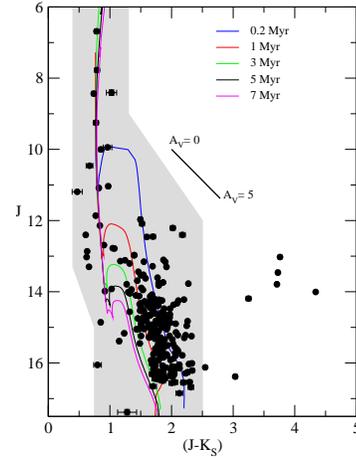


Fig. 1. The decontaminated CMD of Pismis 24 fitted by PMS+MS PARSEC isochrones 0.2, 1, 3, 5 and 7 Myr and $Z=0.019$ (solar). Reddening vector for $A_v=0-5$ mag is shown

rive structural parameters. Noise in the RDPs is minimised with colour-magnitude filters, which exclude stars with colours that are not compatible with those of the cluster. Whenever possible, we fit a two-parameter King-like profile $\sigma(R) = \sigma_{bg} + \sigma_0 / (1 + (R/R_c)^2)$ (King 1966) adapted to star counts, where σ_0 and σ_{bg} are the central and residual stellar densities, and R_c is the core radius. The structural σ_0 and R_c parameters are derived from the fit, while σ_{bg} is previously measured in the comparison field and kept constant.

In some aspects, the NGC 6357 complex emulates a star-forming dwarf galaxy, in the sense that besides a rich content of interstellar features it has ECs pointing to at least two stellar generation events.

REFERENCES

- Bonatto, C. & Bica, E. 2007, A&A, 473, 445
 Cappa, C. E., Barbá, R., Duronea, N. U., et al. 2011, MNRAS, 415, 2844
 Fang, M., van Boekel R., King, R. R., et al. 2012, A&A, 539, A119
 King, I. R. 1966, AJ, 71, 64
 Russeil, D., Zavagno, A., Motte, F., et al. 2010, A&A, 515, A55

¹VISTA Variables in the Vía Láctea Survey.

²Universidade Federal do Rio Grande do Sul, Departamento de Astronomia CP 15051, Porto Alegre 91501-970, Brazil (eliade.lima@ufrgs.br, bica@if.ufrgs.br, charles@if.ufrgs.br).

³Departamento de Física, Universidade Federal de Sergipe Av. Marechal Rondon s/n, 49100-000, São Cristóvão, Brazil.

⁴<http://stev.oapd.inaf.it/cgi-bin/cmd>