

Characterizing the variability of Melotte 111 AV 1224: a new variable star in the Coma Berenices open cluster

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Abstract. A search for new pulsating stars in the Coma Berenices open cluster was carried out. As a result of this search, the cluster member Melotte 111 AV 1224 presented clear indications of photometric variability. In order to determine its physical parameters, Strömgren standard indices and low-resolution spectra were acquired. In this work, we present the preliminary results of these observations.

Keywords. stars: variables, open clusters and associations: individual: Melotte 111

1. Introduction

Coma Berenices (Melotte 111, RA = $12^{\text{h}}23^{\text{m}}$, DEC = $+26^{\circ}00'$, J2000.0) is the second closest open cluster to the Sun. The *Hipparcos* distance of Melotte 111 is $d = 89.0 \pm 2.1$ pc (van Leeuwen 1999), in agreement with older ground-based estimates (e.g. 85.4 ± 4.9 pc, Nicolet 1981). The metallicity of the cluster has been derived by several authors. For example, Cayrel de Strobel (1990) determined $[\text{Fe}/\text{H}] = -0.065 \pm 0.021$ dex, whereas Friel & Boesgaard (1992) found $[\text{Fe}/\text{H}] = 0.052 \pm 0.047$ dex. The age of the cluster is estimated between 400 and 500 Myr (Bounatiro & Arimoto 1993). As its physical parameters are well constrained, the variability studies in Melotte 111 are very important. We carried out a search for new pulsating stars in the direction of Melotte 111. As a result of this search, the star Melotte 111 AV 1224 was found to be a new variable star. This star was originally designated AV 1224 in the astrometric catalogue for the area of Coma Berenices (Abad & Vicente 1999). It is listed as a cluster member in the Simbad database. This work presents preliminary results aimed at characterizing the variability of this target.

2. Observations, data reduction and conclusion

The CCD observations of the Melotte 111 open cluster have been made with the 0.84-m f/15 Ritchey-Chrétien telescope at OAN-SPM observatory, during ten consecutive nights, between April 11 and 20, 2009. The telescope hosted the filter-wheel ‘Mexman’ with the Marconi (E2V) CCD camera, which has a 2048×2048 pixels array, with a pixel size of $15 \times 15 \mu\text{m}^2$. The typical field-of-view in this configuration amounts to $7' \times 7'$. The observations were obtained through a Johnson *V* filter. The usual calibration procedures for CCD photometry have been carried out during our observing run. Sky flat fields, bias and dark exposures were taken every night. The resulting light curve is not sinusoidal, but is strictly periodic; the frequency spectrum reveals two peaks, $2f_1 \sim 5.8 \text{ d}^{-1}$, $A = 23.2$ mmag and $f_1 \sim 2.9 \text{ d}^{-1}$, $A = 10.6$ mmag. The light curve of AV 1224 phased with its main period, $1/f_1 = 0.34$ d, is shown in Fig. 1a. We have also derived the following *V*

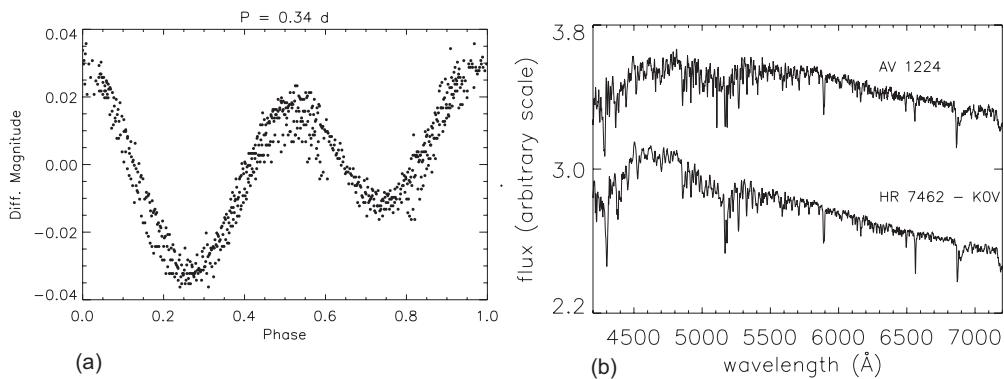


Figure 1. (a) Light curve of AV 1224 phased with the period of 0.34 d. (b) Spectrum of AV 1224 and HR 7462, a star of similar spectral type.

magnitude and indices in the Strömgren system for AV 1224: $V = 13.709$, $(b-y) = 0.526$, $m_1 = 0.276$, and $c_1 = 0.320$.

Spectroscopic observations of the star were conducted with the 2.12-m telescope of the OAN-SPM observatory in June 2011. We used the same equipment as explained by Baran *et al.* (2011). In particular, we used Boller & Chivens spectrograph installed in the Cassegrain focus of the telescope. The 400 lines/mm grating with a blaze angle of 4.18° was used. The grating angle was set to 7° to cover wavelength range from 4000 \AA to 7500 \AA . A 2048×2048 E2V CCD camera was used in the observations. The typical resolution of the recorded spectra is 8 \AA and the dispersion amounts to 1.8 \AA per pixel. The reduction procedure was performed with the standard routines of the IRAF package. Fig. 1(b) shows the reduced spectrum of AV 1224 and, for comparison, the spectrum of a standard star of spectral type K0 V taken on the same night. Considering the Strömgren indices and the stellar spectrum, the variability of AV 1224 due to pulsations can be ruled out. Its light curve resembles rather those observed in W Ursae Majoris-type variables (W UMa), also called EW stars. As it is known, the components of W UMa systems are in contact and are main-sequence stars of nearly the same spectral type, from around middle A to early K. Their orbital periods range from 0.2 to 1.4 days. An in-depth analysis of these observations will be given elsewhere.

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