

THE COOL GALACTIC R Coronae BOREALIS VARIABLE DY Persei

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ABSTRACT. DY Per (CGCS 372) was suspected to be an R CrB star based on the photometry by Alksnis (1994). Subsequent photometric monitoring revealed a number of sudden light declines typical for R CrB variables superimposed on the 792-day cycle of long-period light variations (Alksnis et al. 2002). However, the temperature of this star is much lower than average for other R CrB stars. Moreover, the luminosity of DY Per was suspected to be lower than usually for R CrBs. Keenan & Barnbaum (1997) estimated $T_{\text{eff}} \simeq 3500$ K using the standard criteria of spectral classification and a giant luminosity. DY Per was classified as R8, C4,5, C5,4p, and C-Hd 4.5 C₂ 6 (Keenan & Barnbaum 1997). Alcock et al. (2001) revealed four stars similar to the Galactic variable DY Per among eight RCBs discovered in the Large Magellanic Cloud.

Key words: Stars: carbon; stars: winds, outflows; (stars:) circumstellar matter; stars: individual: DY Per

The imaging photometry of DY Per was taken with the Lulin 1-meter telescope (LOT), equipped with a Princeton Instruments PI 1300B CCD camera. High-resolution spectra for DY Per and the comparison star U Hya were obtained with the coudé échelle spectrometer MAESTRO fed by the 2m telescope at the Observatory on the Terskol Peak in Northern Caucasus equipped with a CCD detector with a resolving power of $\sim 45\,000$.

An inspection of the high-resolution spectrum of DY Per observed near the light maximum relative to the normal carbon star U Hya shows that neutron-capture elements are not enhanced while the features due to atomic carbon are strong, in agreement with that for typical R CrB stars. The metallicity was found to be nearly solar. The isotopic ^{13}CN lines are not enhanced in the spectrum of DY Per relative to ^{12}CN . Unfortunately the spectral regions around H_{α} and H_{β} are very crowded to clarify the level of hydrogen deficiency in the atmosphere of DY Per.

A significant changes are seen in the profiles of

sodium D lines between two seasons of observations. At least five components are resolved. Averaged D1&D2 heliocentric velocities of these components on 2002 (phase 0.77) and 1990 (phase 0.15) are $(-197.3, -143.0, -57.0, -36.7, -12.8)$ km s⁻¹ and $(-214.4, -157.8, -56.8, -36.6, -10.4)$ km s⁻¹, respectively. Thus two the most blueshifted components display changes both in the radial velocity and shape while three components near the stellar velocity of DY Per seems to be non- variable. The blueshifted components apparently are formed in the clouds of gas and dust ejected by DY Per. The rest revealed components originate in the stellar atmosphere and interstellar medium.

A close nearby star was detected about 2.5 arcsec from DY Per using CCD images during the recent deep light decline. The carbon star DY Per itself is much redder than the companion so a clear separation is seen in the B band. At longer wavelengths DY Per starts to outshines the companion. The presence of such companion was not revealed during more than 10 years of the photometric monitoring, however, it was supposed by Alksnis (1994) to interpret the variations of the observed colour indices. This anonymous companion, with observed colour indices (B-V)=1.35 and (V-R)=0.87, may be a foreground K 2–4 dwarf.

The complete paper was published in *Astronomy & Astrophysics* (see Začs et al. 2005).

Acknowledgements. This research has been supported by grant 05.1863 from the Latvian Council of Science. The Mutual Fund of scientific collaboration among Taiwan (ROC), Latvia and Lithuania is thanked for support.

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