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Hα VARIATIONS OF THE SPOTTED G DWARF AP 149

SAVANOV, I.[1]; STRASSMEIER, K.[1]; ROMANYUK, I.[2]; KUDRYAVTSEV, D.[2]

[1] Astrophysical Institute Potsdam, An der Sternwarte 16, D-14482 Potsdam, Germany; e-mail: isavanov@aip.de, kstrassmeier@aip.de

[2] Special Astrophysical Observatory RAS, Nizhnij Arkhyz, Zelenchukskaya, Karachai-Circassian Republic, 369167, Russia; e-mail: roman.@sao.ru, dkudr@sao.ru

AP 149 is a rapidly rotating G dwarf with a rotation period of 0.32 days, $v \sin i$ of 102 km s^{-1} and an inclination of 30°(Barnes et al., 2001). It belongs to the α Persei cluster at a distance of 180–187 pc and an age of about 50 Myr. Barnes et al. (1998, 2001) and Jeffers et al. (2002) used the advantages of a multi-line cross-correlation technique to gain S/N in order to perform Doppler imaging of several α Persei cluster G dwarfs. Their image reconstructions demonstrated that these stars have high latitude and/or polar spots and low latitude features. The original aim of our work was to extend the work by Barnes et al. (1998, 2001) by studying the starspot distribution on a few α Persei cluster stars several yeas after their initial observation. In this paper, we present some first science verification data.

Spectroscopic observations of AP 149 were to be obtained with the 6m telescope of the SAO RAS on the nights of October 22 and 23, 2002. The 2K×1K CCD camera was used with the main stellar spectrograph in the Nasmyth focus. With an entrance slit of 1″, the spectral resolution was R=24,000. The spectral region from 6200 Å to 6610 Å was selected. It includes the 6400 Å – 6440 Å region often used for Doppler imaging as well as Hα at 6563 Å for the search for variations of its profile.

We intended to obtain full phase coverage for AP 149 during these two consecutive nights. Unfortunately, due to the weather conditions only 3 spectra of 30 min exposures each were obtained on October, 23. The heliocentric Julian Dates of the exposures are 2,452,571.2792, 2,452,571.3160, and 2,452,571.3417. They were supplemented by calibration spectra including Th-Ar, flat field, and bias, and two spectra of the comparison star HD 10780 (K0V). Data reduction was done at SAO with the MIDAS package. S/N ratio for the spectra of AP 149 is about 30-40. A fragment of the spectra of AP 149, as well as HD 10780, is shown in the left part of Fig. 1.

The most prominent spectral feature is the Hα emission line (Fig. 1). The range of variability in the emission line profiles can be estimated from the plot in the lower right panel of Fig. 1. A double-peaked profile is evident at the phases of our observations but, after the subtraction of the theoretical hydrogen line profile convolved with the appropriate rotational profile for AP 149 of 102 km s^{-1} (Barnes et al., 2001), the Hα profiles exhibit a triangular shape with additional features possibly connected with transients (Barnes et al., 2001). Synthetic spectra were calculated with the atmospheric parameters $T_{\rm eff}$=5500 K and $\log g$=4.0 from the Kurucz (1993) grid of models with solar metalicity.

The equivalent width of the Hα emissions is 4.2, 4.6 and 4.9 Å from the 3 spectra, respectively, with errors less, than 0.1 Å, thus we observed a real increase. Under the assumption of V=11$^{\rm m}$.71 (Barnes et al., 2001) the flux radiated in Hα is in the range of (0.26 – 0.31) 10^{-12} erg cm^{-2}s^{-1}Å^{-1}.

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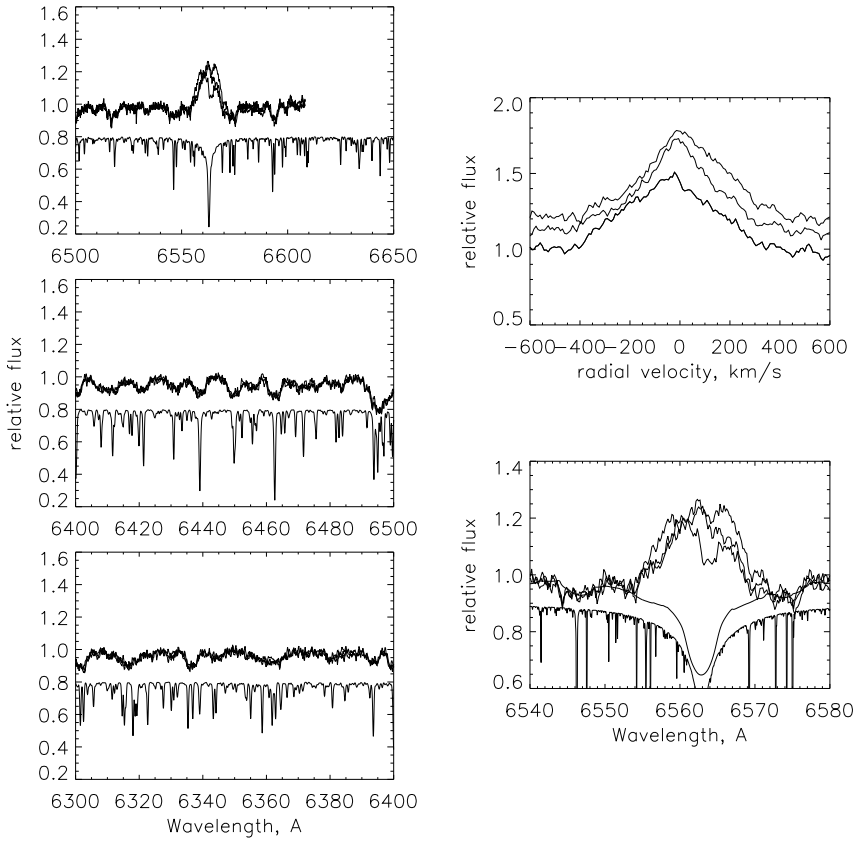

Figure 1. Left column: High-resolution spectra of AP 149 (top) and, for comparison, HD 10780 (bottom, shifted) in three wavelength ranges. Right column: Top: Residual Hα line profiles after subtraction of a synthetic spectrum for our 3 observation (profiles were arbitrarily shifted). Bottom: Hα profiles of AP 149 compared to the unbroadened synthetic spectrum (shifted by -0.1) and its broadened version.

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