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Spectral and photometric monitoring of the classical symbiotic star V1413 Aql in 2008-2013

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Abstract. We present the results of our spectroscopic and photometric observations of the classical symbiotic star V1413 Aql obtained during different stages of its activity.

Key words: stars – symbiotic stars – V1413 Aql

1. Introduction and Observations

The symbiotic stars are interacting binaries composed of a cool giant and a hot compact companion (a hot white dwarf in most cases). These systems demonstrate different types of activity.

V1413 Aql has an anomalous duration of the periods of its quiescent and active states. According to observations obtained in 1983-2013, the hot component of V1413 Aql was in the quiescence no more than one year. Its new activity cycle probably began in January 2009 (see Munari et al., 2009). Our observations demonstrate that in 2008 the star had not yet come to quiescence after the previous outburst (Esipov et al., 2013).

The photometric *UBV* and *JHKL* observations of V1413 Aql are carried out with 0.6 and 1.25-m telescopes at the Crimean Station of the SAI. Some $UBVR_cI_c$ observations were taken with the CCD, mounted on the 0.6-m telescope of the Slovak Academy of Sciences (Tatranská Lomnica). The spectroscopic observations with low resolution are performed with the 1.25-m telescope at the Crimean Station of the SAI and with the 2.6-m Shain mirror telescope at the Crimean Astrophysical Observatory.

2. Spectral and photometrical evolution

Sharp and deep minima connected with eclipses of the active hot component by the red giant are clearly seen on the *V* light curve (see fig. 1a). It's interesting

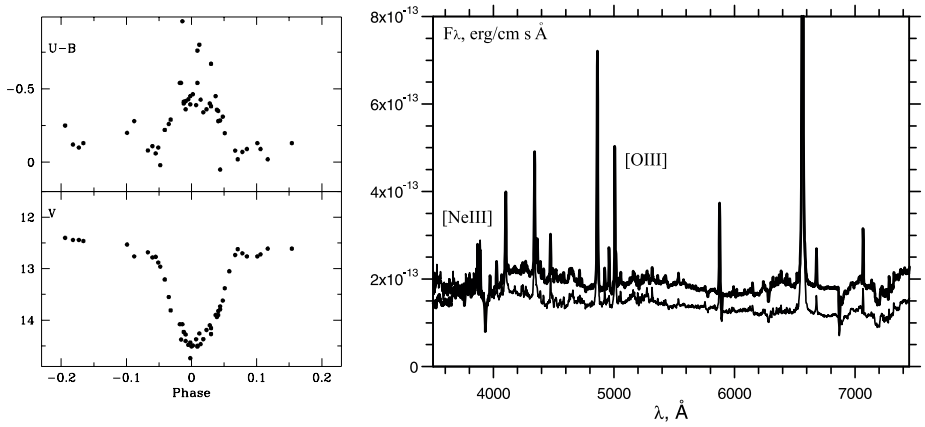

Figure 1. a) V and $U-B$ curves for V1413 Aql during the last minimum. b) Dereddened spectra obtained on 5.11.2012 (bottom line) and 20.09.2011 (top line).

to note that the system in the eclipses was considerably bluer in the $U-B$ color index than it was outside the eclipses. This means that the color from the active hot component of V1413 Aql is redder than that from the nebula. Fig. 1a shows that in 2012 a slight decrease in the color index $U-B$ and V-brightness were observed at phases -0.1 and 0.1. We analyze eclipses observed in 2011 and 2012 and estimate the sizes of the components if the system is seen edge-on: the radius of the cool component is $R_g = 0.28A$ and the radius of the hot component is $R_h = 0.17A$ (A is a semimajor axis).

As described in Esipov et al. (2013) the spectral energy distribution of the active hot component near the maximum of the outburst (April 15, 2010) was consistent with as late spectral type as K2 (not an A-F spectral type).

Our last spectrum was obtained on 5.11.2012 (after eclipse 2012). The SED was nearly the same as that obtained during the previous outburst (24.02.1994). We can see in Fig. 1b that a continuum level was slightly lower than that on the spectrum obtained on 20.09.2011, but forbidden lines showed great difference. The nebular lines of [OIII] become sufficiently fainter and [NeIII], 3868 line is almost invisible. These features indicate that the activity phase of V1413 Aql is continuing. No evidence of decline to quiescence has been detected until now.

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