VV Cep Outside Eclipse

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Summary

The Hα-emission- and line profile behavior outside of eclipse from VV Cep was studied in the sense of a long-term monitoring so far only by Wright (1977). Here own measurements are presented and compared with the data of Wright.

VV Cep Outside Eclipse (published in IBVS 5398)
The 1997-1999 eclipse of the binary VV Cep gave researchers further opportunities to analyze the system. Bauer, Bennett and Brown (1998) attributed strong, double-peaked emission lines such as Mg II and Fe II in the ultraviolet range 2700-3000Å to an expanding atmosphere. They also reported that the hot B star was, during one orbital period, shrouded in a rich absorption spectrum of singly ionized elements.

According to Leedjärv, Graczyk, Mikolajewski and Puss (1999) the eclipse occurred 68 days later than predicted which may indicate an orbital period change due to mass transfer between the M and B stars. Further, they suggested that the cooler object may be an asymptotic giant branch star instead of a supergiant. Graczyk, Mikolajewski and Janowski (1999) came to the same conclusion. They found masses for the M and B stars of about 2.5 and 8 solar masses, respectively, with a total mass ejection of 0.008 solar mass and a loss rate of 4x10^-4 solar mass per year.

In an earlier paper (Pollmann,2001) I presented observations of Hα-emission strength in VV Cep, as measured in equivalent width (EW), from JD 2450202 to 2452061. The rate of sampling was high enough to reveal the eclipse in detail and to show asymmetric distribution of Hα-intensity across the accretion disk as determined at the times of ingress and egress.

In this paper I report on continued observations in the period JD 2452061 to 2452619. I used the 200 mm Schmidt-Cassegrain telescope at the Cologne Stargazer's Association Observatory in the mountains of Odenthal, Germany (latitude: 51°02' longitude: 7°15'). My spectrograph with diffraction grating has a dispersion of 0.39 Å/pixel and a wavelength range of 6600Å to 6700Å.

The detector is a Kodak KAF600 sensor with 768x512 pixels. Pixels are 9x9 micrometers. The resolving power is R = 8200. Current results reveal apparent stochastic variation in Hα-EW with a range of about 10Å outside of eclipse. Despite these dispersions the EW seems to have increased after the eclipse within the period represented here with an upward gradient of approximately 1 Å/200d. There is also variability on a timescale of many hundreds of days. In Fig. 1 the latter is identified by a linear fit to post-eclipse observations.

Exploration of both types of change is a likely project for the years leading up to the next eclipse that begins in 2017.

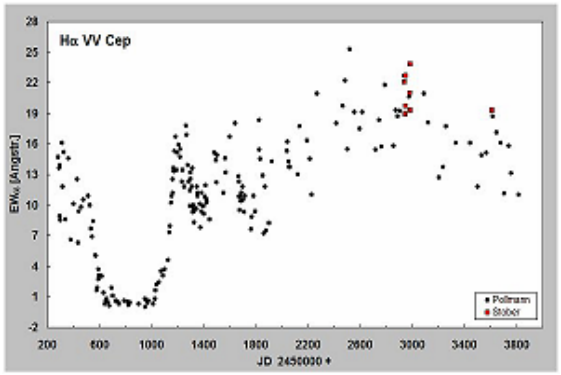

Fig.1: Hα-equivalent width as a function of time for VV Cep before, during, and after the 1997-1998 eclipse

Wright (1977) observed Hα-emission outside of eclipse between 1956 and 1976. I determined V/R ratios from his Fig. 4 plots and show them in Fig. 2 along with my V/R results.

Wright observed nearly an entire orbit with relatively few observations, while I was limited to phases from 0.14 to 0.24 with relatively more observations.

Fig. 2 shows a phase-related cycle of change in V/R. In the short but significant range in which we overlap, my results agree with the pattern of rapid

decrease detected by Wright. Erratic, short-term change in V/R is also indicated.

Line profiles for my first an last observations and reversal of the VR-ratio in March 2006 appear in Fig. 3. I continue to observe Hα-emission in VV Cep and will report again in the future.

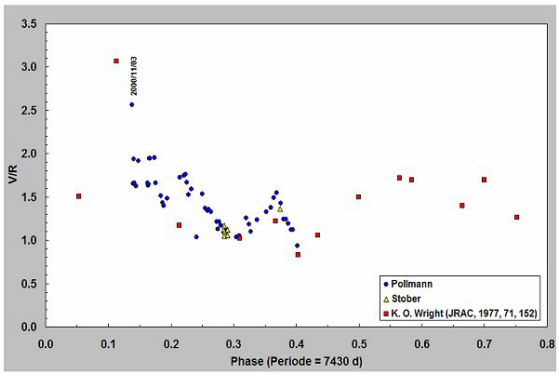

Fig. 2: V/R ratio for the Hα-emission line as a function of orbital phase as independently observed by Wright and Pollmann and Stober (member of the VdS-spectroscopy-group)

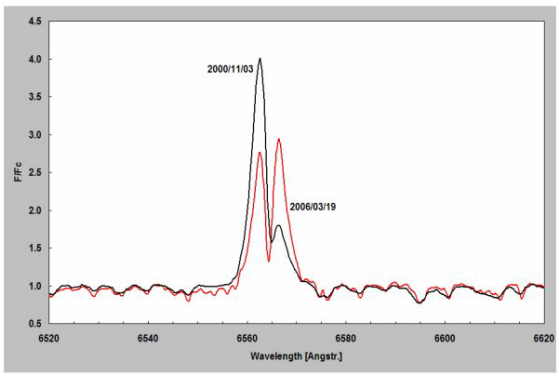

Fig.3: Hα-emission line profiles at JD 2451852 and 2453813 as they appeared at phases 0.14 and 0.4, respectively

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