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On the Hα Emission Phase of β Cep

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Abstract. During the past five years, we monitored the Hα line of β Cep. The strength of the Hα emission, first discovered in 1990, is linearly declining with time. Several options are explored, but a satisfactory explanation for the recurring phases of Hα emission is not yet found.

1. Introduction

We report on the Hα emission phase that is presently observed for the pulsating B2 III star β Cep ($P_{\rm pul} = 4^h34^m$). The Hα emission, which was first observed (Mathias et al. 1990) in July 1990 (and absent in 1985), is superposed on the Stark-broadened photospheric absorption profile and has a Gaussian shape. The Hα emission reached maximum strength at the end of 1990 and is presently decreasing in strength, but still well pronounced.

A similar Hα emission phase was observed in 1956 (Wilson & Seddon 1956) and apart from that, several cases of incipient Hα emission have been reported during this century. The characteristic "β Cep" pulsation seems not to be affected by the presence of the Hα emission (see also Telting et al., this issue).

2. Discussion

The origin of the observed Hα emission is unclear. As a first option, the Hα emission could be caused by a Be-star-type equatorial disk. Be stars and β Cep stars share the same region in the HRD and the Hα emission officially classifies β Cep as a Be star. It has been suggested (e.g., Balona 1990) that the two phenomena are mutually exclusive. However, transitions from Be to β Cep stars (and vice versa) or Be stars with β Cep characteristics have been observed. Although β Cep might be a pole-on Be star, the Hα emission is much weaker than observed for some "classical" Be stars. Secondly, Pigulski & Boratyn (1992) showed that β Cep has a close companion in an eccentric orbit of 92 years. Bedding (1993) reported a similar discovery for the B star δ Sco, for which Hα emission has been detected (Coté & Van Kerkwijk 1993). Both β Cep and δ Sco are candidates for having a circumstellar cloud (Gurzadyan & Rustambekova 1987), which may perhaps be formed during periastron passage. The orbital period, on the other hand, does not correspond to the recurrence time-scale of

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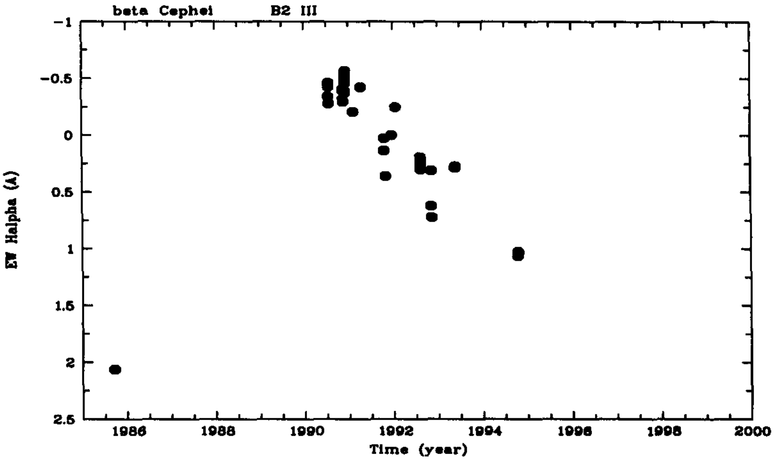

Figure 1. The Hα emission of β Cep is gradually declining in strength. The EWs have been corrected for the presence of telluric lines and the C II lines around 6580 Å. We expect that the Hα emission phase will end around 1998.

Hα emission. Thirdly, Chapellier (1986) suggested that a 30 years cycle might be present in the radial-velocity curve's amplitude, with minima around 1920 and 1950. The apparent change in radial velocity amplitude could be due, however, to the multi-periodicity in β Cep's pulsational behaviour (Aerts et al. 1994). Lastly, Henrichs et al. (1993) proposed that the periodic change in EW found in the UV resonance lines of β Cep is caused by modulation of the stellar wind by an oblique dipolar magnetic field at the stellar surface. The period of 12 days would then correspond to the stellar rotation period. One might speculate that a changing magnetic field configuration has consequences for the distribution of wind material close to the star, and thus the amount of Hα emission.

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