The Mons campaign on OB stars

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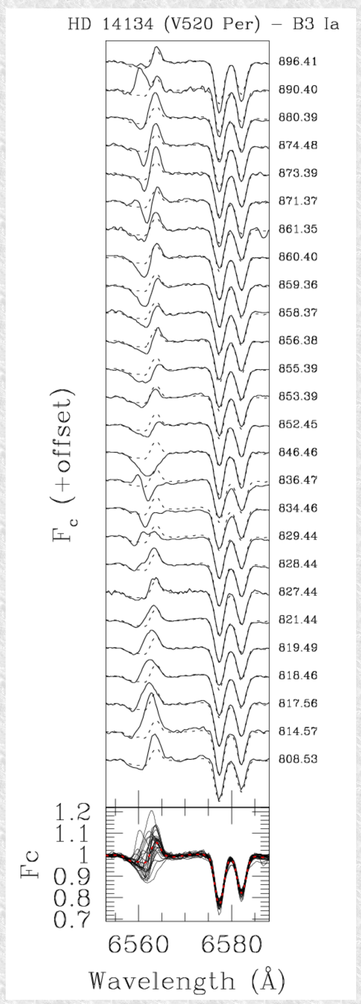
Context

The so-called Mons project is a collaboration between professional and amateur astronomers, which was primarily set up to monitor the periastron passage of the colliding-wind binary system WR 140 centred on January 12, 2009. A spectroscopic campaign was organised to that effect from December 2008 to March 2009 using the 50-cm Mons telescope at Teide Observatory (Canary Islands). Time-resolved spectroscopy of the Hα line (6360-6950 Å, 0.34 Å pix^{-1}) was also obtained for a number of early B-type supergiants and Oe stars to investigate the properties of the large-scale wind structures in the B supergiants and of the circumstellar material in the Oe stars. Here we present an overview of the variations observed and briefly discuss forthcoming developments in the data analysis.

The B supergiants

Variability studies in the UV domain have shown that the wind of OB supergiants is likely made up of large-scale streams (the 'co-rotating interaction regions'; CIRs) whose formation may be triggered by the existence of non-uniform physical conditions at the stellar surface (due, e.g., to magnetic structures or pulsations; Cranmer & Owocki 1996, ApJ, 462, 469). Optical wind lines, such as Hα, can be used to probe the physical properties of these structures. In particular, revealing rotational modulation in these lines would provide evidence that the CIRs extend relatively close to the star and are possibly directly emerging from the photosphere.

Four B1-B3 supergiants have been monitored for variations in Hα: HD 14134, HD 42087, HD 43384 and HD 52382. Strong, daily line-profile variations are observed in all the targets, as illustrated in the case of HD 14134 by the great variety of profiles observed (pure emission/absorption, double peaked, classical or inverse P Cygni profile). This star is also of particular interest because of the previous detection of a 12.8-d periodic signal both in photometry and in spectroscopy (Morel et al. 2004, MNRAS, 351, 552).

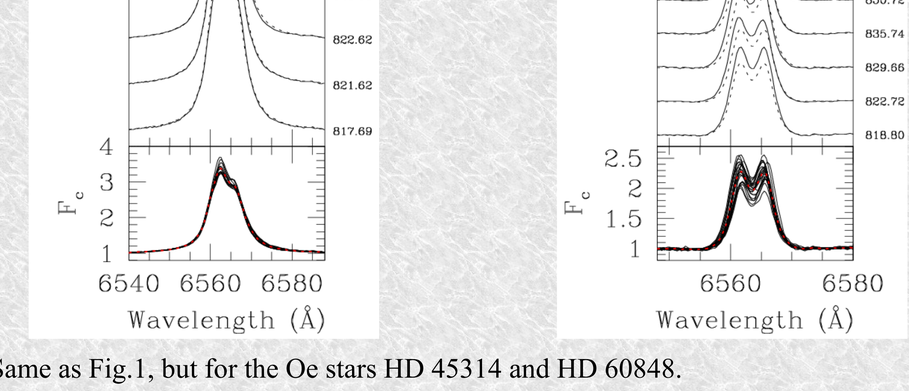


Figs 1a-d: Variations of the Hα line in the B supergiants HD 14134, HD 42087, HD 43384 and HD 52382. The mean profile is shown as a dashed line. The date of the observations (HJD-2,454,000) is indicated to the right of the upper panel. The bottom panel shows a superposition of all the profiles with the mean profile overplotted as a dashed, red line. The two absorption features are C II lines.

The Oe stars

The rare, fast-rotating Oe stars constitute the extension to higher temperatures of the Be stars (Negueruela et al. 2004, AN, 325, 749). Studying the variations of the Hα line can be used to investigate the temporal evolution of their circumstellar disk. Variations are known to take place both on yearly (Rauw et al. 2007, IBVS, #5773) and hourly timescales (Boyajian et al. 2007, PASP, 119, 742), but the variations on timescales of weeks are less documented.

We have monitored HD 45314 and the high-latitude star HD 60848. Changes in the strength of Hα are observed, in particular in HD 60848, but these variations generally seem to take place on longer timescales than those seen in the B supergiants.



Figs 2a-b: Same as Fig.1, but for the Oe stars HD 45314 and HD 60848.

Conclusions and perspectives

- Our observations support the idea that strong variations of the Hα line operating on timescales of days/weeks are commonplace in both B supergiants and Oe stars.
- However, our main goal is to detect the *periodic* changes that would allow us to identify the physical process(es) that drive the variations. For instance, a dipole magnetic field tilted with respect to the rotational axis in the Oe stars is expected to induce changes modulated by the rotational period, whereas the variations should take place on much longer timescales if they arise from some kind of disk instabilities. A detailed period search will be performed in the future.
- The B supergiants have already been intensively monitored in 2001-2002. It will be of interest to examine whether the pattern of variability remains coherent over such timescales.
- The Oe stars, especially HD 45314, present quite a rich spectrum with various Fe II and/or He I emission lines. A great deal of information about the disk properties can also be gained from studying these lines.
- On the other hand, one of our objectives for the future is also to collect high-resolution spectroscopic observations to examine the existence of pulsations in the B3 supergiant HD 14134; the ultimate goal being to link the variations taking place at the photosphere to those in the wind.

More information about the Mons project at:
http://www.stsci.de/wr140/index_e.htm
(see also contributions by T. Eversberg and R. Fahed)

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