SPECTROSCOPIC SURVEILLANCE OF THE VARIABLE HERBIG Ae STAR AB AUR

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AB Aur = HD 31293 = BD + $30^0$741 = MWC 93 = HRC 78n is one of the brightest members of a class of pre-main sequence objects introduced by G. Herbig in 1960. The star is characterized by a spectral type of A0Ve, $L/L_\odot$ = 70, m_v = 7.2 mag, $v \sin i$ = 140 km/s, and d = 140 pc. Assuming a stellar radius of a main sequence dwarf $R/R_\odot$ = 3.0, one can estimate the rotational period to be on the order of 28 hours if we see the system edge on. Previous work (Praderie et al. (1985) and Finkenzeller (1983)) has focused on high resolution spectroscopy and shown that AB Aur is subject to short term variations. Finkenzeller's observations have indicated that the emission features can disappear completely within a day. Praderie et al. found evidence of a rotational modulation (45 ± 6 hours) of the MgII λ 2795 and FeII UV lines which is interpreted as due to a non-axisymmetric wind interacting with the outer atmosphere.

Since AB Aur is a typical representative of the Herbig Ae and Be type stars, reasonably bright, and easily accessible we have initiated a spectroscopic surveillance program to monitor optical line variations. We were guided by the wish to achieve a temporally well resolved and contiguous data set in order to investigate short term variability ($t \leq 1h$) and to separate a superposed rotational modulation. It was hoped that the analysis of these data would yield an activity period which would be interesting to compare with the rotational period as deduced from photospheric lines.

All observations were carried out with the Boller and Chivens spectrograph at the 72 cm Waltz reflector of Landessternwarte Heidelberg-Königstuhl. The spectrograph can be used in conjunction with a two or three stage magnetically focused EMI image tube. (Work is under way to replace this detector by a linear diode array). The intensified spectrograph of the Landessternwarte is an ideal instrument to perform the surveillance project outlined above.

We confined our studies to H_β. Typical exposure times were on the order of 20 minutes with the two stage image tube. The spectra have a resolution of R ≈ 2000 at 22 Å/mm and were recorded on IIaO plates. After digitising the data with a Grant microdensitometer the reduction followed standard procedures. A subset of the final

J. B. Hearnshaw and P. L. Cottrell (eds.), Instrumentation and Research Programmes for Small Telescopes, 443–445.

spectrograms is displayed in fig. 1. In order to have a direct measure of the degree of activity, the residual emission strength has been determined by subtracting an undisturbed photospheric line profile, based on a Kurucz model. The variation of this value, corresponding to the spectrograms of fig. 1, is given in fig. 2.

Clearly, AB Aur did vary appreciably during the time covered by the program. A markedly on/off event as observed by Finkenzeller (1983) in February 1981 could not be seen. Changes can be verified down to scales of about an hour. It would be premature, however, to assign any period to the data values available at this point.

The presented observations should be considered as a pilot study to monitor fast rotators of intermediate mass among the pre-main sequence stars. These first results are encouraging and we intend to continue the program.

References

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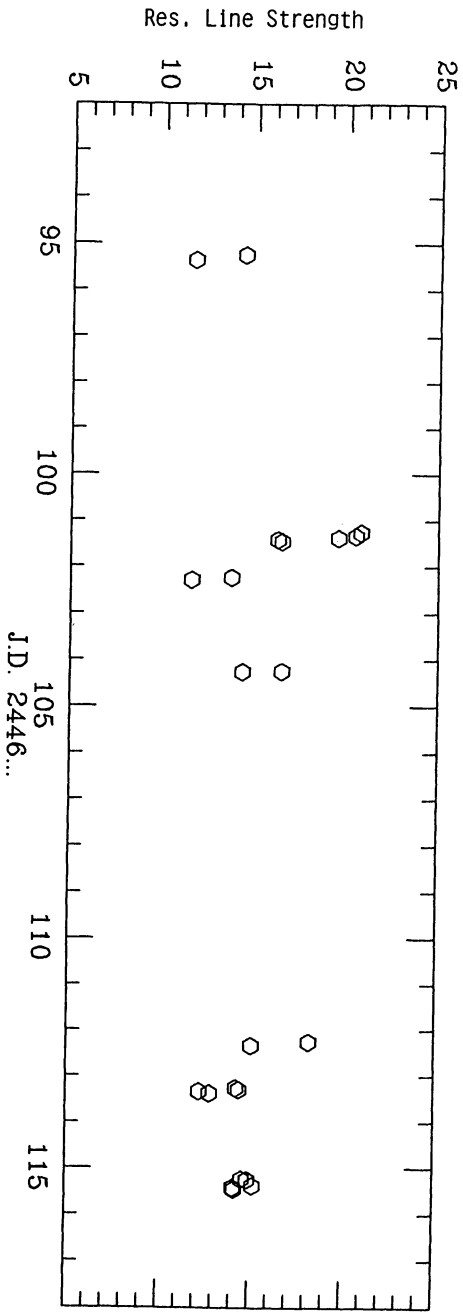
https://doi.org/10.1017/S0074180900151861 Published online by Cambridge University Press

Fig.1 (right). Line profile variations of the Herbig Ae star AB Aur at $H\beta$. The numbers on the ordinate give J.D. 2446... Appreciable changes occurred within a fraction of a day.



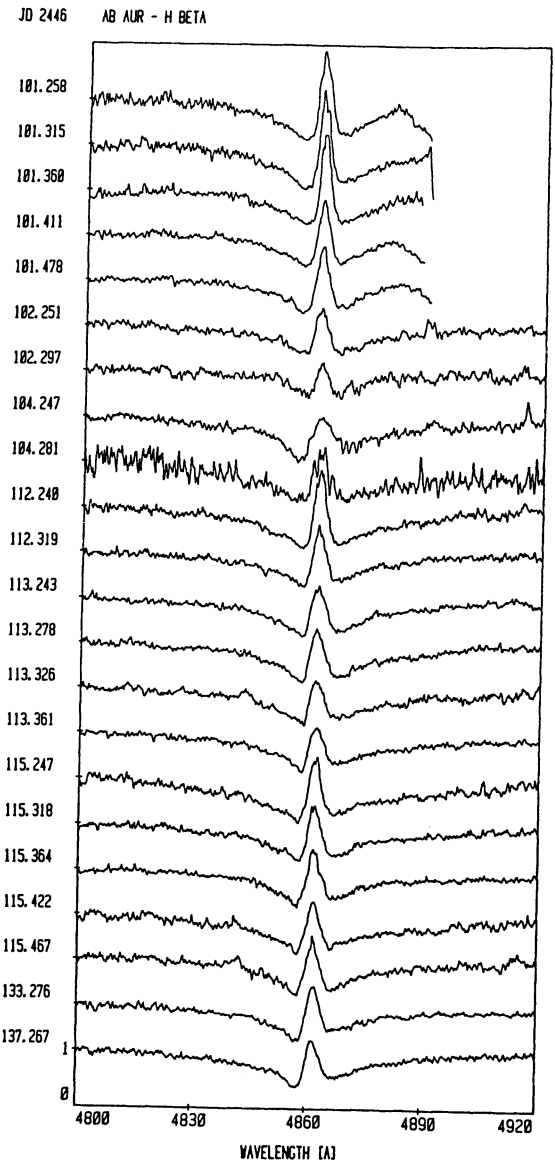


Fig.2 (left). Residual emission line strength after subtraction of an undisturbed photospheric line profile for the spectrograms shown in fig.1.

https://doi.org/10.1017/S0074180900151861 Published online by Cambridge University Press