

LONG-TERM BEHAVIOR OF H α EMISSION IN BU Tau

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One approach to better understand Be stars is to provide systematic, frequent, long-term monitoring of the magnitudes and spectra of these objects. This is something that amateur astronomers can do. Those who are equipped with appropriate spectrographs and who can systematically observe these stars over years can supply information about changes in H α equivalent width (EW). In this note, I report my spectroscopic observations of the H α emission line in BU Tau (Pleione, 28 Tau) measured in units of EW. H α emission was first detected in BU Tau by E. C. Pickering in 1890. Hirata (1995) describes the range of research on this interesting object in an excellent survey.

For all but two observations of BU Tau, 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 6400Å to 6700Å. The detector is a Kodak KAF400 sensor with 768×512 pixels. Pixels are 9×9 micrometers. The resolving power is R=10.000. This telescope and instrument serve my extensive Be star monitoring program. For observations on JD 2450840 and JD 2451165, I used a Maksutov objective prism spectrograph that has f=1.000 mm, a flint glass prism with 30-degree breaking angle, and a dispersion of 5.6 Å/pixel. Its resolving power is R=1.500. CCD frames containing spectra were processed with standard techniques, and H α emission line EW's were measured in Richard Gray's program, MK32.

The variations of the spectrum of BU Tau, from 1938 to 1975, have been described in detail by Gulliver (1977) who give a well documented bibliography of the star. I did not observe the development of absorption lines for singly ionized elements in BU Tau such as appeared in the spectrum of 88 Her in 1959, as Balmer emission decreased. Figure 1 shows H α behavior from JD 2440601 to JD 24526648 (1970 to 2003). This includes observations by Hirata (1995), Klotz (2003), Slettebak and Reynolds (1978), Andriolat and Fehrenbach (1982), Fontaine et al. (1982), Sharov, Lyutyi, and Esipov (1994), Menchenkova and Luthardt (1993), and Ojha and Joshi (1991). My observations cover the period JD 2450840 to JD 2452648. A minimum of about 2Å occurred in emission strength near JD 2441584, while a maximum of 41Å was achieved about JD 2450840. Hirata (1995) describes the overall increase in EW as an effect of an active Be phase. Given this condition, interesting, brief decreases in EW occurred at JD 2445187 and JD 2449367 in route to maximum.

My measurements began when the intensity of H α was near maximum. Immediately following, however, came a very steep descent to a brief minimum of about 5Å. Harmanec

(1993) interprets the steep rise that was first observed on JD 2451850 as evidence for a new Be phase. Figures 2a and 2b compare line profiles as observed at different times with the two spectrographs. The table lists my individual measurements of EW, FWHM (full width half maximum) and peak intensity for H α emission.

Table 1

HJD	EW [Å]	FWHM [Å]	Intensity F/F _c
2450840.315*	41	20.1	2.89
2451165.377*	37	21	2.55
2451586.363	5	4	1.28
2451852.439	14	5.6	3.01
2451873.481	21	7.1	3.95
2451923.314	31	7	5.45
2452618.356	28	7.2	5.7
2452649.365	27	7.3	5.21

*: Objective prism spectra (dispersion=5.6 Å/pixel).

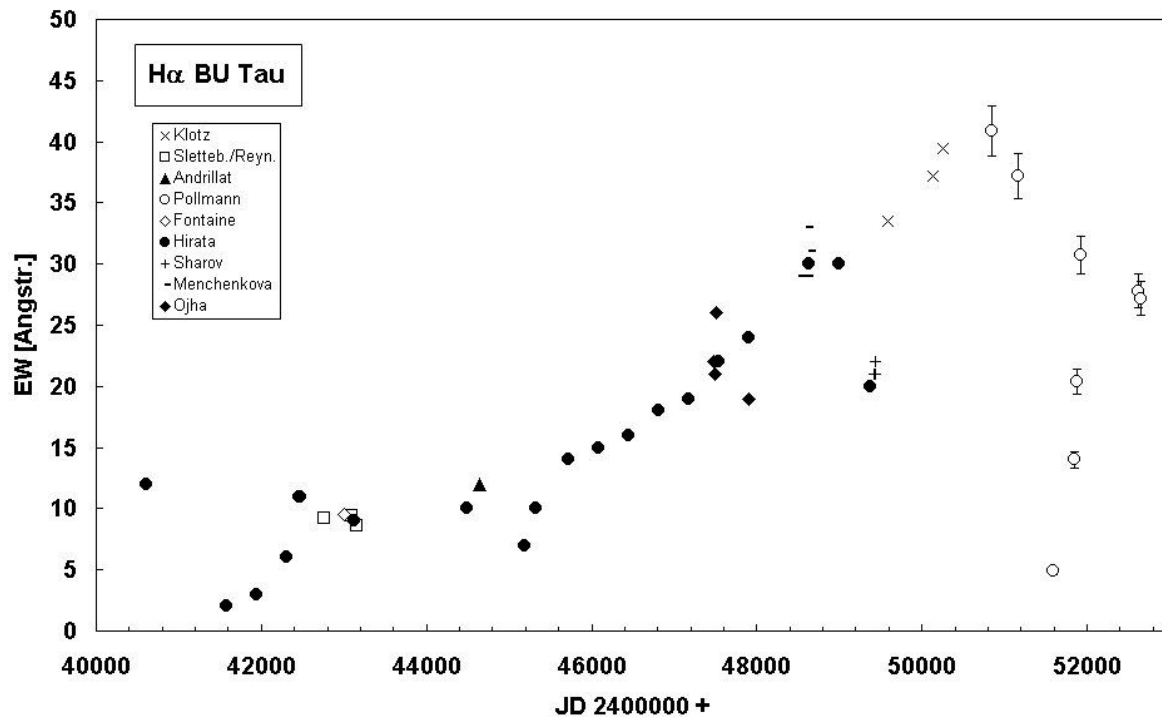


Figure 1. Changing H α intensity in BU Tau over 33 years as measured by several observers.

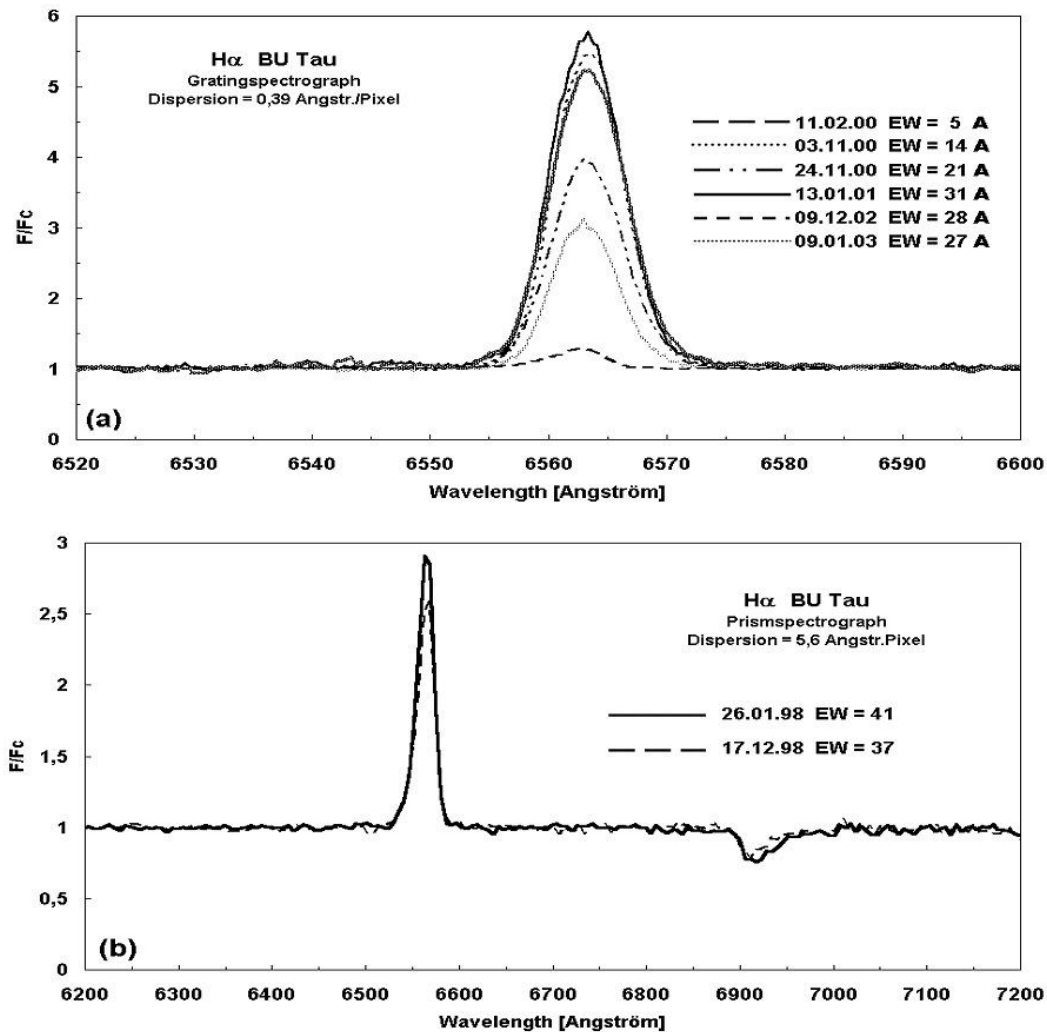


Figure 2. Comparison of H α emission line profiles in BU Tau from JD 2450840 to JD 2452648 with results from the grating spectrograph and the objective prism spectrograph shown in 2a and 2b, respectively.

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