

Activity on T Tauri Stars

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1 Observations

We have made a detailed investigation of the short-term variability of the classical T Tauri star BP Tauri in *UBVRI*. Data were collected from the Wendelstein Observatory in 1991, 1992 and 1993 with time resolutions down to 1 sec. The 0.8m telescope was equipped with a fiber-fed fifteen channel high-speed photometer (Barwig et al. 1987). Observations (in *UBV*) were also collected in China at the Yunnan and Shanghai Observatories to get a long base line in time. To search for differences in the properties between the brightness variations of classical T Tauri stars (CTTS) and T Tauri stars with weak emission lines (WTTS) we performed simultaneous photometry (in the *UBV* and Strömgren systems) and spectroscopy of 6 young stars during two observing periods at ESO La Silla. The study concerned mainly short-term variability on time-scales of minutes to a few hours. The sample contained two CTTS, SY Ori and VW Cha; three WTTS, San 1, SZ Cha and ADA 481 and one post-T Tauri candidate, HD 70309B.

2 Results

We found no pronounced flare activity on BP Tauri. Most of the time the star was constant or varied only very slowly in brightness. The few distinct events observed had amplitudes of $0^m.1$ to $0^m.3$ in the *U*-band and temperatures < 8000 K. The optical energy release of these events ranges from 10^{35} to 10^{36} ergs and there was a striking lack of events with lower energies. No brightness variations with time durations of < 0.6 hours were observed. Normally the rise time of an event was comparable to the decay time. One active night of BP Tauri is shown in the figure. The activity of BP Tauri can most easily be understood in terms of inhomogeneous accretion from a disk towards the star. The short time-scales of the variations favour models with magnetically controlled accretion.

The simultaneous spectroscopic and photometric observations showed that the short-term brightness variations of CTTS and WTTS behaved differently. We could distinguish between two types of fast events: (a) Rapid bursts of durations

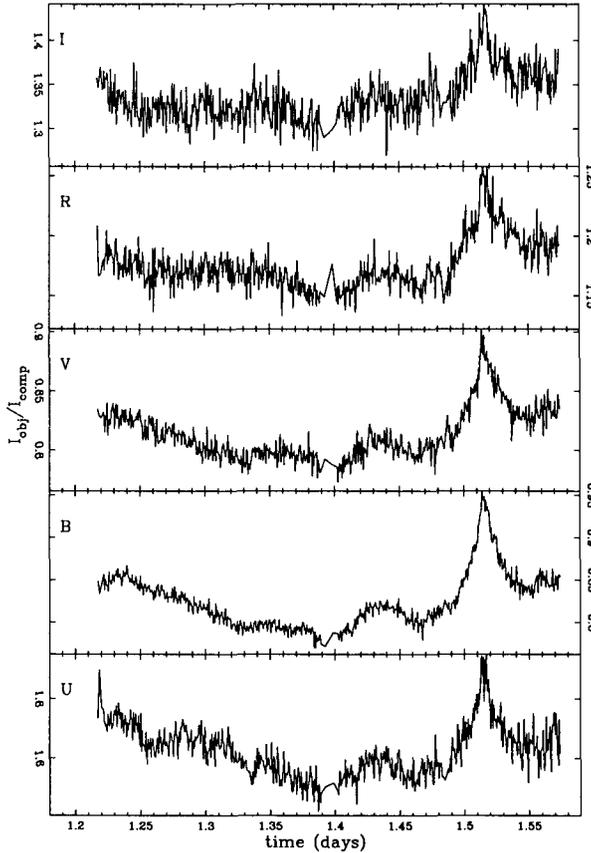


Fig. 1. High-speed photometry of BP Tauri. The time is given at JD 2449004+.

less than an hour, manifested solely in the Balmer continuous and line emission. Such events were found only on the WTTS. (b) Slow and smooth changes occurring over several hours in particular for VW Cha, where we could show that variable veiling dominates. These investigations show that the mechanisms behind most of the activity on CTTS and on WTTS are different. Accretion from circumstellar disks are probably responsible for the observed variability on CTTS, while magnetically active regions cause the short-term variability on WTTS.

References

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