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THE DISCOVERY OF 5.37 DAY PERIODICITY OF VY Tau

Herbig (1977) was the first to pay attention to the large amplitude eruptive variable VY Tau. He suggested that spectral and photometric variations of the star were close to those of EX Lup stars. According to Meinunger (1969,1971) in 1969-1971 VY Tau showed at least 9 large-scale light increases and declines with amplitudes amounting to 4 mag. Not less than 5 such large-scale eruptions similar to U Gem outbursts were recorded in 1928-1959, the most important one with the amplitude near 5 mag being observed in 1941. Stone (1983) started UBV-photoelectric monitoring of the star in 1971 just immediately after the last light increase, but since 1972 he has failed in attempting to record any large-scale changes.

Our observations of VY Tau have been made at the Mt. Maidanak 60-cm Zeiss telescope with UBVR(I) pulse counting photometer since 1980. The limits of the light variations, average colours and number of observations are listed in Table 1. Variations in the V light level are shown in Figure 1. Stone's photoelectric observations and our ones together provide strong evidence that VY Tau did not show any large light changes and kept a deep minimum (B = 15.1 mag) in a time interval as long as 18 years. The previous longest quiet period was observed in 1928-1941.

To search for a periodic component in light variability, our observations made in 1987-1990 were analysed by methods of digital spectral analysis (Berdnikov et al., 1991, Grankin et al., 1991). The analysis yields a period of 5.37 days. Average light curves with the period in BVR are plotted in Figure 2. We emphasize the distinction of the light curves in different filters. The dispersion in the light curves is much larger than observational errors (0.03B, 0.02V, 0.012R). The dispersion is the least in R, where the periodic process is the most distinct. At the same time the amplitudes of the periodic

process are about equal for each filter. The dispersion in the average curves increases sharply near their minima in V and B. In addition, one can often see an excessive flux +0.1> B >+0.3 along the whole light curve.

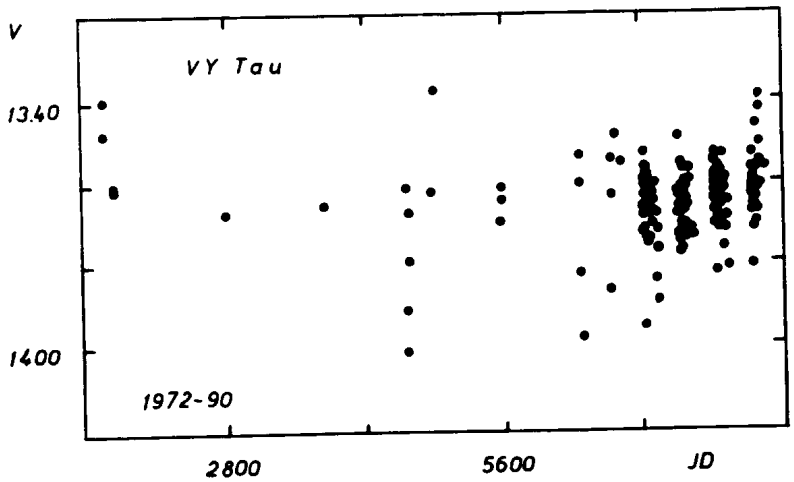

Fig.1. The light curve of VY Tau.

Table 1. Photometric data

J.D. 2400000+	n	Vmax	Vmin	<V>	<U-B>	<B-V>	<V-R>
44612 - 44643	6	13.62	14.02	13.841	1.26	1.55	1.50
44845 - 44936	11	13.21	13.82	13.785	0.82	1.43	1.58
45261 - 45302	4	13.34	13.75	13.683	1.22	1.55	1.47
45559 - 45613	4	13.40	13.65	13.526		1.40	1.59
46702 - 46798	5	13.49	13.64	13.557	0.93	1.55	1.43
47020 - 47173	43	13.54	13.77	13.535	0.83	1.47	1.49
47384 - 47537	59	13.56	13.78	13.665	1.08	1.48	1.45
47744 - 47887	60	13.54	13.82	13.649	1.12	1.49	1.47
48130 - 48265	42	13.40	13.72	13.610	0.77	1.47	1.46

Figure 3 shows the B-R colour changes as a function of the brightness in B for VY Tau (dots).This dependence is represented by the line labelled (1).The periodic component of variability may in principle be caused by rotation of the star with hot and cool spots .If the temperature of the star changed when its radius remained constant, its position on

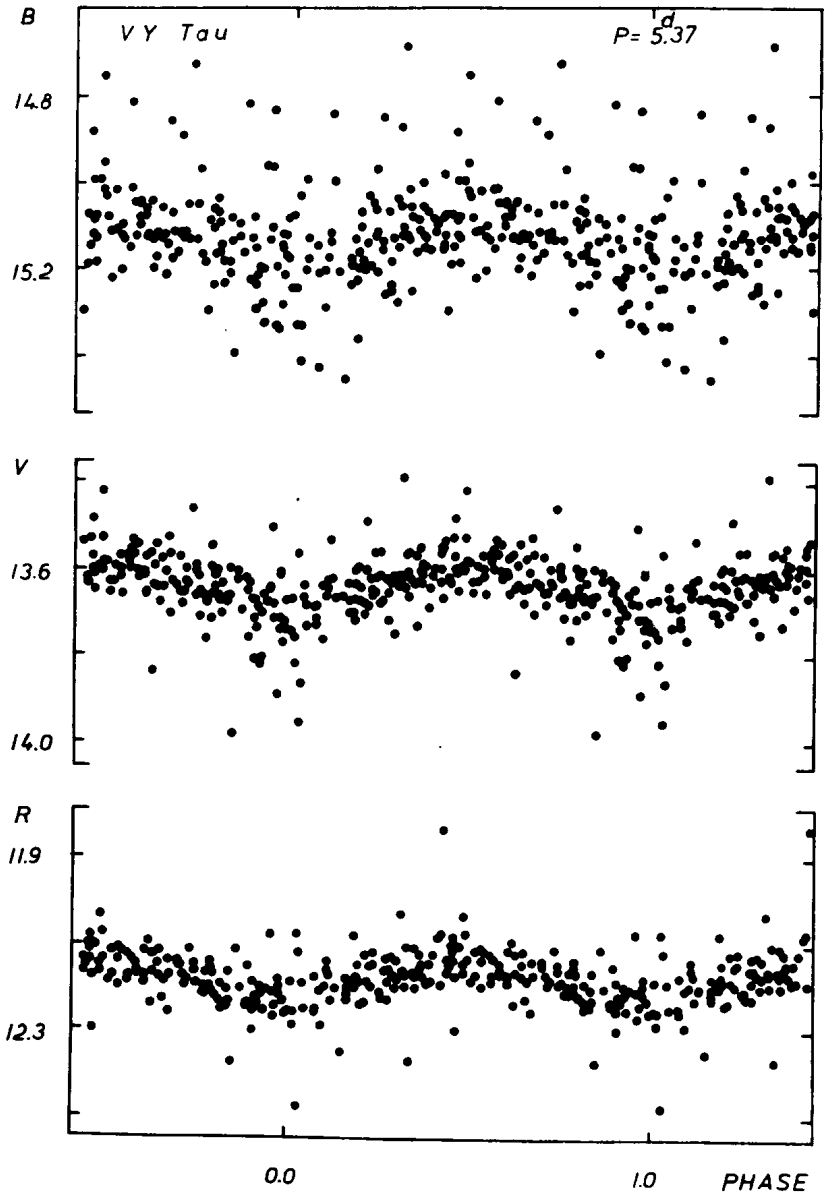

Figure 2. The folded light curves of VY Tau in BVR - bands.

the B-(B-R) diagram would move along (2). But it is curious that the spots did not change appreciably their location and area during 4 yrs observations. For comparison the line of increasing interstellar reddening with a similar slope is also shown (3). The periodic component may also be caused by changing opacity in the star shell by the law of the absorption similar to the normal one (3). Accidental light variations in B may be transients due to flares. The interpretation of the colour changes (1) in Figure 3 presents the greatest difficulties. The increase of the dispersion near the folded light curve minima in Figure 2 may be interpreted with the aid of "quasialgol" BO Cep hypothesis (Grankin et al.,1991). In 1990 the light curve shows a small light rise and perhaps the quiet long period is to be finished.

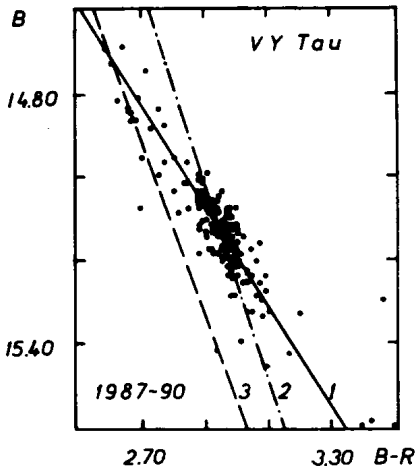

Fig.3. The B-V colour changes of VY Tau

K.N. GRANKIN, M.A. IBRAGIMOV, S.Ju. MELNIKOV, V.S. SHEVCHENKO, S.D. YAKUBOV
Tashkent Astronomical Institute, USSR

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