COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4978

Konkoly Observatory
Budapest
31 October 2000

HU ISSN 0374 – 0676

BVRI OBSERVATIONS OF KT PERSEI IN OUTBURST

SPOGLI, CORRADO[1]; FIORUCCI, MASSIMO[1]; RAIMONDO, GABRIELLA[2]

[1] Osservatorio Astronomico, Università di Perugia, Via A. Pascoli I-06100 Perugia, Italy

[2] Teramo Astronomical Observatory, Collurania, Teramo, Italy

KT Persei is a well known dwarf nova (DN) of the Z Cam subtype, characterized by an orbital period of 0.1627 days and a typical time interval between two subsequent outbursts of 26 days (Ritter & Kolb 1998). The secondary has a spectral type of M3.3 $\pm$ 1 and an apparent brightness of $V = 17.9$ (Thorstensen & Ringwald 1997).

The observations were taken at the Astronomical Observatory of Collurania–Teramo with the 0.72-m Ritchey–Chretien reflector, equipped with a Tektronix 512 CCD camera and B, V (Johnson), R_c, I_c (Cousins) filters. The photometric techniques used have already been described by Spogli et al. (2000a and 2000b). We calibrated some of the comparison stars in the finding chart reported by Misselt (1996). The standard magnitudes are reported in Table 1. Considering the standard deviation, our data are in agreement with the measurements carried out by Misselt (1996), but show small systematic differences with respect to the data published by Henden & Honeycutt (1997). In any case differences are always within three standard deviations. Moreover we have included the calibration for the I_c filter.

Table 1: BVR_cI_c magnitudes of the selected comparison stars

No.	B	V	R_c	I_c
1	13.09 ± 0.04	12.56 ± 0.04	12.22 ± 0.04	11.86 ± 0.04
4	16.52 ± 0.06	15.16 ± 0.04	14.35 ± 0.04	13.50 ± 0.05
5	15.35 ± 0.05	14.26 ± 0.04	13.64 ± 0.04	13.06 ± 0.05
7	13.93 ± 0.04	13.27 ± 0.04	12.84 ± 0.04	12.41 ± 0.04
8	16.53 ± 0.06	15.68 ± 0.04	15.18 ± 0.05	14.64 ± 0.05

We observed KT Per in August-September 1998 during all the outburst, from the rise to the maximum to the subsequent decline. In Table 2 we report the BVR_cI_c magnitudes while the V light curve can be found in Figure 1. The observed maximum was $V \simeq 12.5$, a value which is fainter than other outbursts observed in this source, but that can be considered quite typical. This outburst follows a particular faint state ($V \simeq 15.6$ in October 27th) that confirms the evidence that sometimes KT Per becomes fainter than the minimum of $V = 15.^{\rm m}4$ listed by many catalogues (Thorstensen & Ringwald 1997). The differences between the minimum and the maximum are: $\Delta B \simeq 3.3$, $\Delta V \simeq 3.0$, $\Delta R_c \simeq 2.7$ and $\Delta I_c \simeq 2.0$.

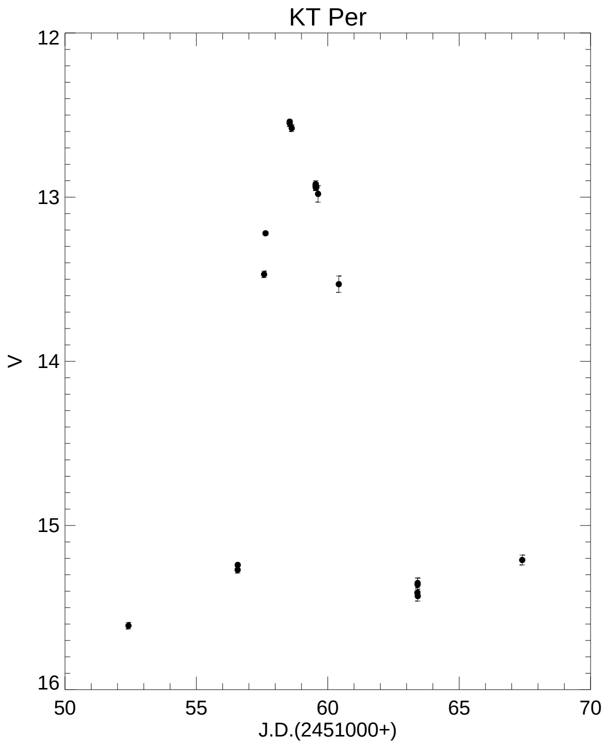

Figure 1. V light curve of KT Per

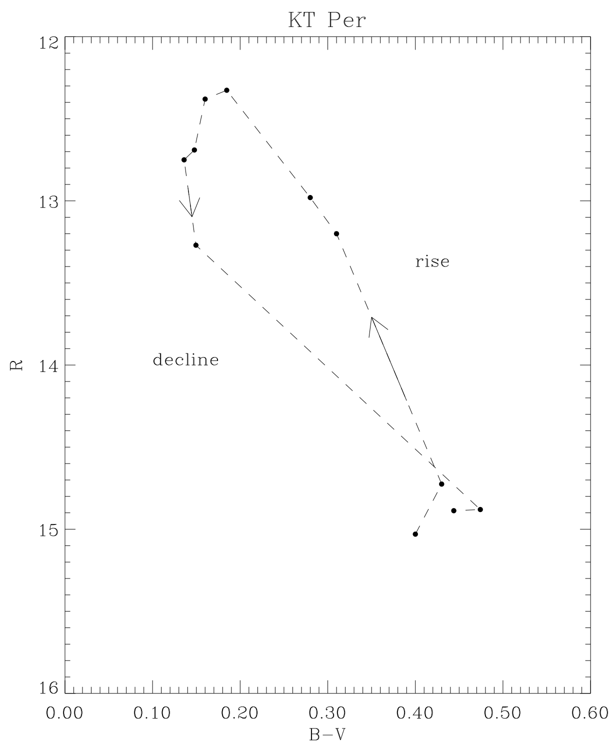

Figure 2. Colour index variations of KT Per during the outburst

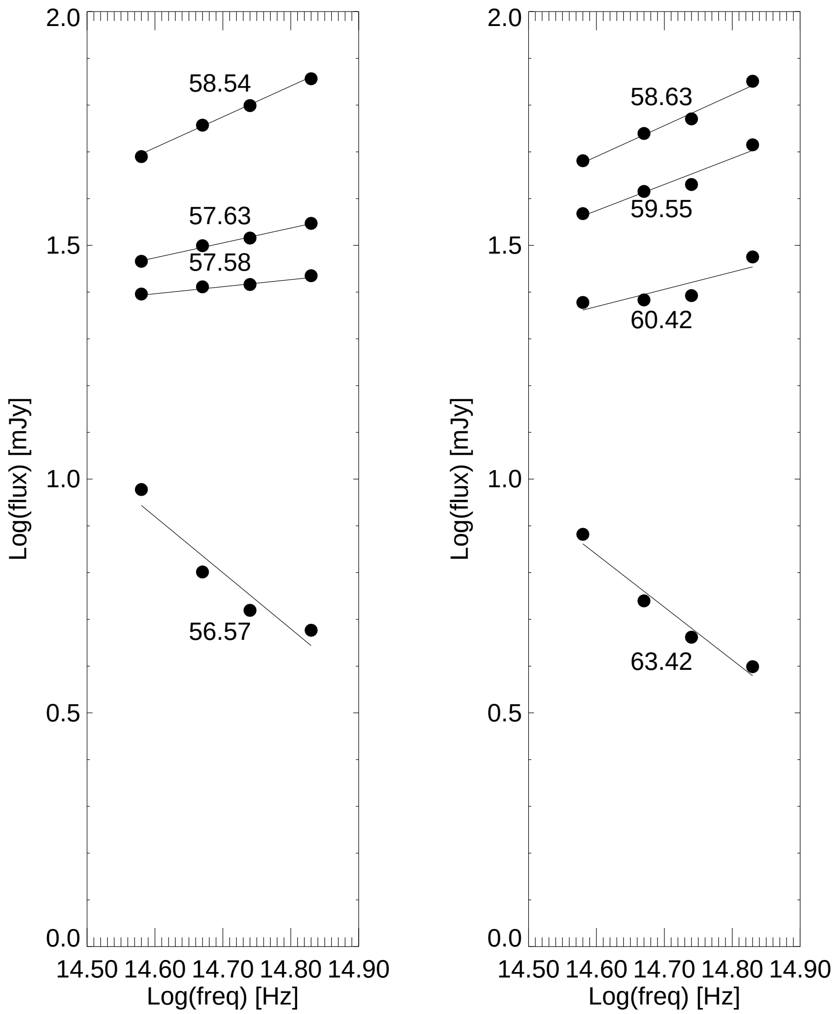

Figure 3. Spectral slope changes in KT Per during the rise (left panel) and the decline (right panel). The date (JD 2451000 +) is reported near the fluxes

Table 2: BVR_cI_c magnitudes of KT Per

JD (2451000 +)	B	V	R_c	I_c
52.4194	16.01 ± 0.05	15.61 ± 0.02	15.03 ± 0.02	14.21 ± 0.01
56.5715	15.69 ± 0.03	15.25 ± 0.01	14.72 ± 0.02	13.94 ± 0.01
57.5769	13.78 ± 0.03	13.47 ± 0.02	13.20 ± 0.02	12.90 ± 0.01
57.6315	13.50 ± 0.03	13.22 ± 0.01	12.98 ± 0.02	12.72 ± 0.01
58.5457	12.73 ± 0.02	12.54 ± 0.01	12.33 ± 0.02	12.16 ± 0.01
58.6273	12.74 ± 0.04	12.58 ± 0.02	12.38 ± 0.03	12.18 ± 0.01
59.5499	13.08 ± 0.02	12.93 ± 0.01	12.69 ± 0.02	12.47 ± 0.01
59.6311	13.12 ± 0.04	12.98 ± 0.05	12.75 ± 0.04	12.51 ± 0.01
60.4197	13.68 ± 0.03	13.53 ± 0.05	13.27 ± 0.04	12.94 ± 0.03
63.4232	15.87 ± 0.03	15.40 ± 0.01	14.88 ± 0.02	14.18 ± 0.02
67.3987	15.65 ± 0.03	15.21 ± 0.03	14.89 ± 0.02	14.20 ± 0.02

Figure 2 shows almost the entire loop of the $B - V$ colour index as a function of magnitude for KT Per. Obviously during the maximum the DN is blue ($B - V \simeq 0.2$) and during the minimum redder ($B - V \simeq 0.4$), but it is important to remark that for the first part of the decline the system remains blue or becomes bluer. This behaviour can be well explained with disk instability models as described in Spogli et al. (2000b). Our data show a large loop in the colour-magnitude diagram for KT Per, therefore constrain theoretical models and suggest that the predicted outside-in outburst of disk instability models are in agreement with the observations.

BVR_cI_c observations of dwarf novae allow to evaluate the optical spectral behaviour and, therefore, they can be used as a test to compare theoretical models of accretion disk emission. In particular they can be used to verify the often quoted theoretical flux distribution of a stationary (infinitely) large accretion disk whose surface elements radiate as black body spectra ($F(\nu) \propto \nu^{1/3}$, see, e.g., Warner 1995).

To study the behaviour of the optical continuum during the outburst, we converted the BVR_cI_c magnitudes in fluxes using the conversion factors reported by Bessell (1979). We corrected our observations for interstellar reddening adopting the value $E_{B-V} = 0.2$ reported by La Dous (1989), then we have $A_V \simeq 0.6$. For a correction of the fluxes in the B, R_c and I_c bands we used the interpolation formula of Cardelli, Clayton & Mathis (1989).

Using the flux values so obtained we noted that at minimum the spectral distribution is dominated by the emission of the secondary star, while at maximum the spectral distribution follows a power law ($F(\nu) \propto \nu^{\alpha}$) with $\alpha \simeq 0.6$. Figure 3 shows the spectral slope changes in KT Per in logarithmic scales. During the decline the high frequency flux remains strong, a behaviour that may be consistent with a strong irradiation of the hot inner part of the disk while the outer part is already cooling.

These data confirm that at least for a sample of DNe (KT Per, SY Cnc, DX And, V660 Her, AL Com, V503 Cyg, see Spogli et al. 1993, 1998, 2000a) it is not possible to approximate their emission during outburst by a sum over all contributions of surface elements of an infinitely large steady-state disk, which radiate like black bodies.

References:

Bessell, H.S., 1979, *PASP*, **91**, 589
Cardelli, J.A., Clayton, G.C., Mathis, J.S., 1989, *ApJ*, **345**, 245
Henden, A.A., Honeycutt, R.K., 1997, *PASP*, **109**, 441
La Dous, C., 1989, *A&A*, **211**, 131
Misselt, K.A., 1996, *PASP*, **108**, 146
Ritter, H., Kolb, U., 1998, *A&AS*, **129**, 83
Spogli, C., Fiorucci, M., Tosti, G., 1993, *IBVS*, No. 3949
Spogli, C., Fiorucci, M., Tosti, G., 1998, *A&AS*, **130**, 485
Spogli, C., Fiorucci, M., Raimondo, G., 2000a, *IBVS*, No. 4944
Spogli, C., Fiorucci, M., Raimondo, G., 2000b, *IBVS*, No. 4977
Thorstensen, J.R., Ringwald, F.A., 1997, *PASP*, **109**, 483
Warner, B., 1995, "Cataclysmic Variable Stars", Cambridge University Press, Cambridge