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FIRST SPECTROSCOPY OF THE DWARF NOVA KX Aql: A POSSIBLE NEW SU UMa SYSTEM

TAPPERT, C.[1,2]; MENNICKENT, R.E.[1]

[1] Grupo de Astronomía, Facultad de Física y Matemáticas, Universidad de Concepción, Casilla 160-C, Concepción, Chile, e-mail: claus@gemini.cfm.udec.cl, rmennick@stars.cfm.udec.cl

[2] Dipartimento di Astronomia, Università di Padova, Vicolo dell'Osservatorio 2, I-35122 Padova, Italy

KX Aql (HV 5428) is a poorly studied cataclysmic variable star. The Downes et al. (2001) catalogue reports a dwarf nova nature with a rather long cycle length (300 days) and a photographic magnitude range 12.5–17.5, although the VSNET[1] and VSOLJ[2] light curves occasionally show the star fainter than 18 mag. To our knowledge, the system has not been examined spectroscopically yet. In this note we confirm the dwarf nova classification, and provide for the first time a detailed description of the optical spectrum.

We obtained a 900-s integration time spectrum of KX Aql on May 30, 2000 (JD 2451694) at the La Silla Observatory using DFOSC at the Danish 1.54-m telescope. Grism #15 combined with a slit width of 2″ yielded a wavelength range of $\sim$ 3800–9100 Å and a spectral resolution of 15 Å. The spectrum was corrected for bias and flat fields, as well as calibrated in wavelength and flux using standard IRAF[3] routines.

The spectrum of KX Aql is presented in Fig. 1. It shows typical dwarf nova features, with strong emission lines of the Balmer and HeI series. Additionally, CaII H (hidden in Hε) and K emission is present at the blue, and the CaII triplet (blended with the Paschen series) at the red end of the spectrum. Table 1 contains all identified emission lines and their basic quantities. Note especially the extraordinary strength of the Hα line ($W_{\mathrm{H}\alpha} > 300$ Å), and the absence of highly ionized lines like HeII. The spectrum furthermore shows no absorption features which could be assigned to the secondary star. A few emission lines remained unidentified due to the low resolution of our data, two other were tentatively assigned to FeII, but a final conclusion has to await high-resolution spectroscopy.

The normalized spectrum in the lower part of Fig. 1 was computed by dividing the calibrated spectrum through a spline fit to the continuum. It emphasizes the strong Balmer decrement, suggesting an origin in an optically thin accretion disc. This, and the strong emission lines in general, indicate that the system was in quiescence during our observations. We folded the calibrated spectrum with Bessell (1990) filtercurves in order to extract spectrophotometric magnitudes, obtaining

$$V = 18.4, \quad B - V = -0.5, \quad V - R = 0.2.$$

[1] http://www.kusastro.kyoto-u.ac.jp/vsnet/gcvs/AQLKX.html
[2] http://www.kusastro.kyoto-u.ac.jp/vsnet/etc/drawvsolj.cgi?text=AQLKX
[3] IRAF is distributed by the National Optical Astronomy Observatories.

Table 1: Properties of the emission lines. Column 1 gives the wavelength determined by a Gaussian fit, column 2 the equivalent width, column 3 the Gaussian FWHM, column 4 the integrated line flux, column 5 and 6 the line identification and the corresponding rest wavelength, respectively. The flux is in units of 10^{-16} erg cm^{-2} s^{-1}. All other values are in Å. Colons mark uncertain values

(1) λ	(2) W_λ	(3) FWHM	(4) F_λ	(5) identification	(6) λ_0	(7) remarks
3898	−47:	20	271:	Hζ	3889	[1]
3943	−45:	11	246:	CaII K	3934	[1]
3979	−54:	21	289:	Hε + CaII H	3970	[1]
4109	−62	24	293	Hδ	4102	
4191	−9	35	31	FeII	4179	uncertain
4244	−7	20	21	FeII	4233	uncertain
4293	−12	13	16			ID?
4347	−111	25	264	Hγ	4341	
4424	−4	20	10			ID?
4479	−15	23	33	HeI	4472	
4867	−159	26	265	Hβ	4861	
4928	−13	23	19	HeI	4922	
4971	−4	30	5			ID?
5028	−13	39	24	HeI	5016	
5176	−13	30	22	FeII	5169	
5882	−60	33	61	HeI	5876	
6566	−320	30	282	Hα	6563	
6681	−32	41	25	HeI	6678	
7068	−25	42	24	HeI	7065	
8515	−76	91	57	CaII/Pa blend		
8665	−41	62	25	Pa13/CaII	8665/8662	
8757	−37	87	17	Pa12	8751	
8881:	−23:	40:	10:	Pa11	8863	[2]

[1] lines are strongly blended

[2] line distorted due to absorption feature (CCD error)

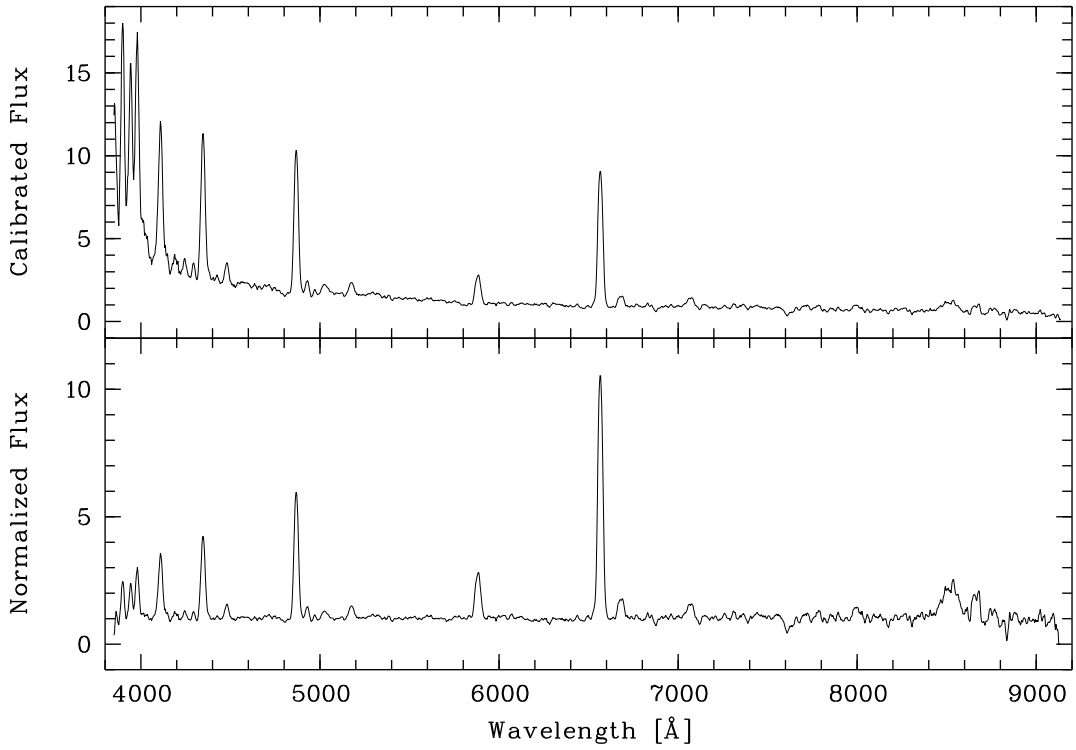

Figure 1. Flux calibrated (in 10^{-16} erg cm^{-2}s^{-1}Å^{-1}, top) and continuum normalized (bottom) spectra of KX Aql

The recorded seeing during the observations was of the order $1\farcs5$. On the basis of previous experiences with the instrumental setup at the 1.54 Danish, we thus expect the calibration to be better than $\sim 0\fm15$ in V considering the slit width of $2''$. This confirms the quiescent state of KX Aql during the observation. It furthermore means that, if the maximum V magnitude is not too far from the listed photographic value of 12.5 (Downes et al., 2001), the system shows long-term variations with $\Delta V \geq 6$ mag.

The optically thin disc, suggested by the properties of the emission lines, points to a state of low accretion rate, and the disc luminosity, i.e. its continuum emission, can be expected to be rather low. The absence of late-type absorption features (e.g., NaI or TiO) therefore indicates a faint secondary star. This, together with the probable large outburst amplitude and the long recurrence time, suggests that KX Aql is a member of the SU UMa star subclass of cataclysmic variables, i.e. a dwarf nova below the period gap with a secondary star less massive than $\sim 0.3\ M_\odot$. The observation of a superoutburst, or the determination of the orbital period, should be the definitive probe of this prediction.

References:

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