

The X-Ray Source 1RXS J051439.2–021615 is a Flare K Dwarf

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We obtained a spectrum and *UBVRI* photometry of the star associated with the X-ray source 1RXS J051439.2–021615 that experienced a rapid optical flare on 25 January 2018 (ATel #11250). We classified the spectrum as K2V–K5V. The H α line was filled with emission. We explain this event as a flare in an active region on the surface of a late-type main sequence star.

On January 25, 2018, Gazeas (2018) detected an optical flare of the star associated with the X-ray source 1RXS J051439.2–021615 (shorter, 1RXS J0514–02). The brightness of the source in the *V* band increased suddenly from the stable level of $12^{\text{m}}84 \pm 0^{\text{m}}01$ to the peak of $11^{\text{m}}85 \pm 0^{\text{m}}01$ within 9 minutes, and then declined exponentially for approximately 45 minutes to $V = 12^{\text{m}}72 \pm 0^{\text{m}}01$ at the end of the night. There is no information on this star in catalogues despite its brightness.

On four nights between March 6 and November 3, 2018, we performed *UBV(RI)_C* photometry of the star using the SAO 1-m Zeiss telescope and CCD photometer based on the EEV42-40 chip, and additionally obtained a spectrum with this telescope and UAGS spectrograph. On the night of November 3, 2018 with an excellent and stable transparency, we determined magnitudes of the comparison and check stars relative to several photometric standards established by A. Henden and U. Munari. These were the standards in the vicinity of CI Cam (Henden & Munari 2006), V838 Mon (Munari et al. 2005), V959 Mon (Munari et al. 2013), V339 Del (Munaru & Henden 2013), and V445 Pup (Henden’s VSNET standard in Goranskij et al. 2010). There was a weak contamination by the light of the nearby star HD 290113 ($V = 9^{\text{m}}55$), which was accurately eliminated in our calculations. The accuracy of observations is $0^{\text{m}}02 - 0^{\text{m}}03$. The results of our photometry for 1RXS J0514–02 along with the comparison and check stars are given in Table 1.

The spectrum of 1RXS J0514–02 was taken on 2018 February 07.763 UT using the UAGS spectrograph with the 1302 grating having the spectral resolution of 2.2 Å and the wavelength range λ 5755 – 7130 Å. The total accumulated exposure was 3600 s. The spectrum was reduced to absolute units using the multicolor photometry. The result is shown in Fig. 1 (top). The absorption lines of Na I D₂ D₁, Ca I, and Ba II typical of a cool star are clearly apparent. The radial velocity of the star determined from single and sharpest Ba II lines is about zero. We compared this spectrum to the spectra from the library by Jacoby et al. (1984) and found its best resemblance with the K5V star SAO 56803 (Fig. 1, bottom). The evident difference is the absence of H α absorption in 1RXS J0514–02, so this line is filled with emission. This is an indication of chromospheric activity, which can explain the flare observed in January, 2018.

The averaged photometric magnitude $V = 13^{\text{m}}087 \pm 0^{\text{m}}020$ and colors $U - B = 0^{\text{m}}200 \pm 0^{\text{m}}039$, $B - V = 0^{\text{m}}882 \pm 0^{\text{m}}027$ suggest a slightly earlier spectral type, K2V, with a large UV excess of about $0^{\text{m}}36$. However, this excess is very small to be radiation from a white

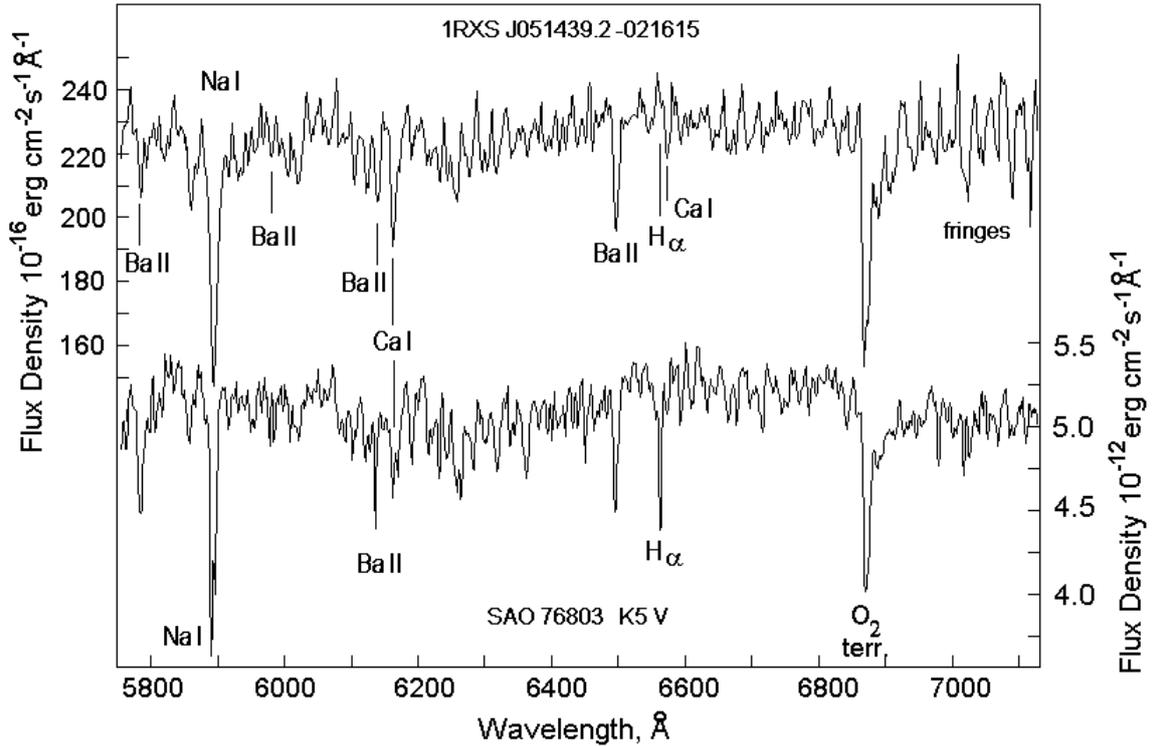


Figure 1. The spectrum of 1RXS J0514-02 (top) compared to the spectrum of the K5V type star SAO 76803 (Jacoby et al. 1984).

dwarf or an accretion disc in a binary system. We suppose that this excess is due to strong Ca II H and K emission at λ 3933 and 3968 \AA , another possible sign of chromospheric activity. There is no interstellar reddening in these colors, suggesting that 1RXS J0514-02 is a nearby object. Note that our V magnitude of the stable level is fainter by $0^m25 \pm 0^m02$ than that given by Gazeas (2018). Some low-amplitude variability at the stable level is possible, mostly in the ultraviolet band.

1RXS J0514-02 is present in the Gaia catalogue with the parallax $\pi = 4.45 \pm 0.13$ milliarcseconds, its distance being 225 ± 7 parsecs. With this distance, the absolute magnitude $M_V = 6^m33 \pm 0^m07$ corresponds to a K2V dwarf.

Having these data, we can conclude that 1RXS J0514-02 is an UV Ceti-type flare star. This phenomenon occurs in stars with KVe and MVe spectra (GCVS). However, the development of the flare observed in February, 2018 was slower than that of typical flares of UV Ceti stars. As noted in the GCVS type descriptions, the brightness rise of such flares continues for several seconds or dozens of seconds, while the flare of 1RXS J0514-02 continued for 9 minutes. Our observations do not show any signs of binarity of this star.

References:

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Table 1: $UBV(RI)_C$ photometry of 1RXS J051439.2-021615 and comparison stars

JD hel.	U	B	V	R_C	I_C
2458184.31	14 ^m 187	13 ^m 972	13 ^m 113	12 ^m 472	–
2458217.22	14.186	13.995	13.100	12.498	12.037
2458369.55	14.184	13.945	13.064	12.465	–
2458426.48	14.119	13.963	13.071	12.471	12.028
Standard J051441.2–021639					
2458426.48	13.683	13.572	12.937	12.556	12.255
Check star J051443.1–021640					
2458426.48	15.997	15.809	15.064	14.602	14.220
	± 0.049	± 0.038	± 0.017	± 0.045	± 0.003

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