

Long term *UBVRI* photometric and spectral monitoring of nova KT Eri during 2009-2023

S.Yu. Shugarov^{1,2}, P.Yu. Golysheva², S. Dallaporta³ and U. Munari⁴

¹ *Astronomical Institute of the Slovak Academy of Sciences
059 60 Tatranská Lomnica, The Slovak Republic (E-mail: shugarov@ta3.sk)*

² *Sternberg Astronomical Institute, MSU, 119234 Moscow, Russia*

³ *ANS Collaboration, c/o Astronomical Observatory, 36012 Asiago (VI), Italy*

⁴ *INAF Padova, 36012 Asiago (VI), Italy*

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Abstract. We present a status report of our intensive and long-term *UBVRI* photometric monitoring of nova KT Eri since its outburst in 2009. The old-nova in quiescence is characterized by very high excitation conditions (HeII 4686 being constantly the strongest emission line in optical spectra) and a complex-pattern photometric variability of one mag amplitude in which multi-periodicities (from hours to years) are mixed with chaotic activity of similar amplitude. Mean color and brightness levels are the same for pre- and post-outburst quiescence.

Key words: nova – spectrum – outburst – color variations

1. The discovery and observations of KT Eri

KT Eri was discovered by K. Itagaki on 2009 November 25.536 UT at 8.1 mag, already on a fast ($t_2=6.6$ days) decline from maximum brightness reached on November 14.67 UT at unfiltered 5.4 mag (Hounsell et al., 2010). Although several properties of KT Eri suggest it could be a recurrent nova, searches for previous outbursts proved (so far) unfruitful (Jurdana-Šepić et al., 2012; Schaefer et al., 2022).

In January 2010 we begun an intensive *UBVRI* photometric monitoring of KT Eri, with a broad assortment of 18–125cm telescopes located in Slovak Republic, Crimea, and Italy. All the photometry has been calibrated against the same photometric sequence presented in Tab. 1 and Fig. 1, which has been carefully tightened to the Landolt’s system of equatorial standards (Landolt, 2009). Our color- and light-curves of KT Eri over 2009-2023 are shown in Fig. 2.

We are also keeping KT Eri under spectroscopic monitoring with the Asiago 1.22m + B&C in low-resolution and absolute flux modes. The mean post-outburst spectrum of KT Eri relative to the 2012–2020 period is presented in Fig. 3, with little changes present among different observing epochs. The very high excitation conditions affecting KT Eri are really apparent by HeII 4686 Å being constantly the strongest emission line of the whole optical range.

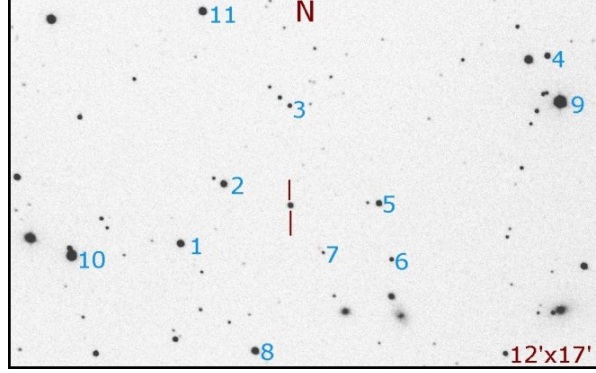


Figure 1. Identification of our photometric comparison sequence around KT Eri.

Table 1. Magnitudes and colors of the photometric comparison sequence in Fig.1.

star	<i>V</i>	<i>U-B</i>	<i>B-V</i>	<i>V-R_C</i>	<i>R_C-I_C</i>	star	<i>V</i>	<i>U-B</i>	<i>B-V</i>	<i>V-R_C</i>	<i>R_C-I_C</i>
1	12.820	0.81	0.998	0.575	0.503	7	16.345	0.01	0.565	0.370	0.334
2	13.267	1.10	1.256	0.816	0.644	8	12.694	0.88	0.981	0.571	0.488
3	15.197	-0.01	0.540	0.386	0.388	9	10.172	0.07	0.540	0.37	0.31
4	13.844	0.41	0.740	0.454	0.381	10	11.561	0.09	0.55	0.32	0.34
5	13.719	0.93	0.981	0.562	0.474	11	12.420	0.31	0.590	0.387	0.336
6	15.099	-0.07	0.540	0.361	0.339						

2. Results

Our color- and light-curves of KT Eri are presented in Fig. 2. The decline time from 2009 maximum is derived to be $t_3=13$ days, confirming the classification

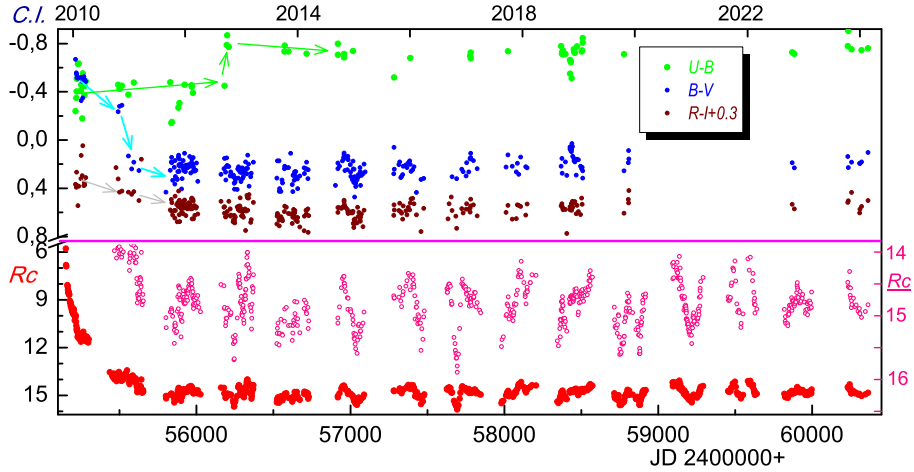


Figure 2. The overall light curve of KT Eri in *R* (lower panel) and color indices (upper panel) during the outburst and in quiescence. For a better visualization, the *R*-band lightcurve of the lower panel is plotted on both full and expanded scales (cf. ordinates on the left and right axes).

as a fast nova. KT Eri returned quickly to quiescence, leveling off at the same $R=15.3$ mag characterizing its pre-outburst brightness on Palomar plates. The

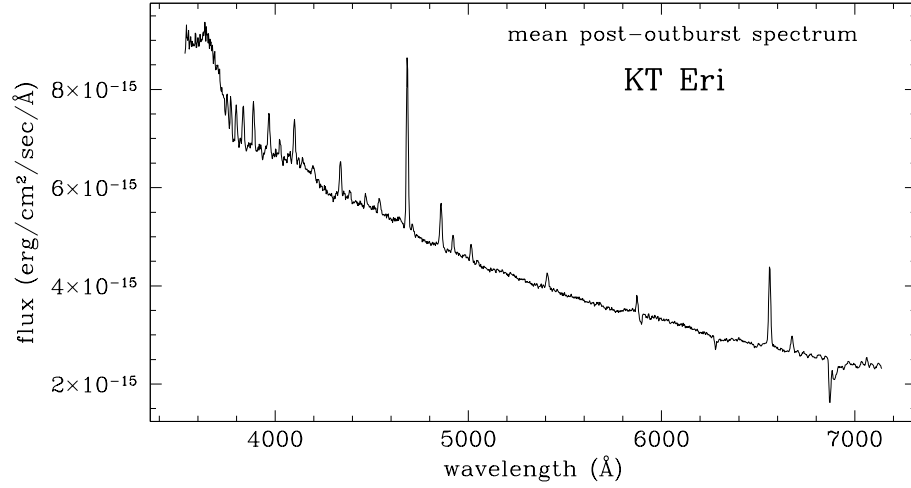


Figure 3. The mean optical spectrum of KT Eri during 2012–2020 yrs.

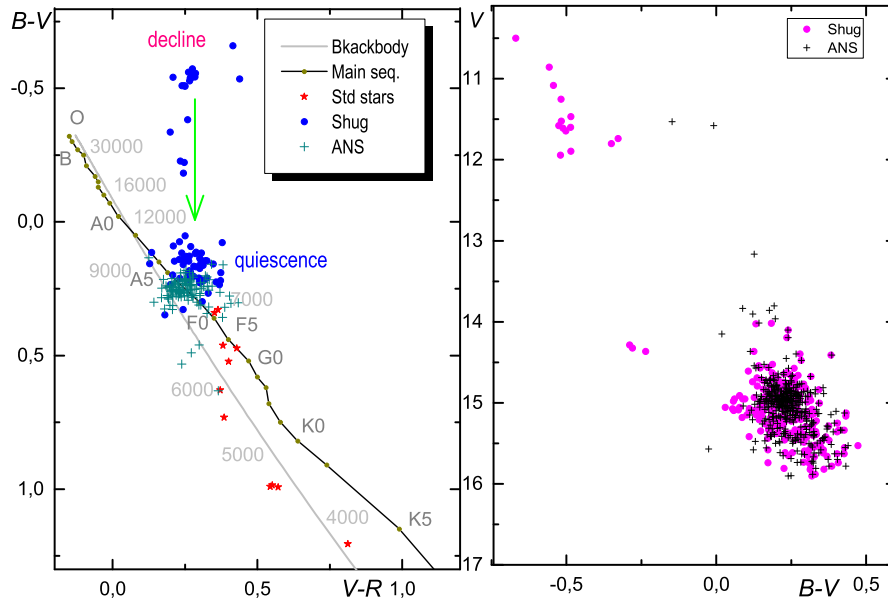


Figure 4. The two-color (left) and color-magnitude (right) diagrams. "Std stars" – positions of neighboring stars (from Tab. 1); "Shug" and "ANS" – positions of KT Eri, obtained by Shugarov and ANS Collaboration (Asiago) teams accordingly.

total outburst amplitude is about ~ 10 mag. Note that the maximum outburst amplitude (~ 19 mag) among classical Nova stars was detected at V1500 Cyg: (Harevich et al., 1975; Honda et al., 1975). The photometric post-outburst quiescence shows the same large variability (~ 1 mag) inferred from inspection of pre-outburst photographic plates (Jurdana-Šepić et al., 2012). It is characterized by various time scales or multi-periodicities, intricately connected and not easy to isolate because not always all of them are present at the same time, which are mixed with a strong chaotic activity that may reach an amplitude of 0.7 mag over a few tens of minutes. The broad assortment of photometric times scales affecting KT Eri (from hours to years, eg. Munari & Dallaporta, 2014; Schaefer et al., 2022) has already been noted. We plan to carry out a comprehensive analysis in search for persistent periodicities by combining pre- and post-outburst available data.

The star track on the $B-V$, $V-R$ planes is plotted in Fig. 4. Apart from bluer $B-V$ colors during the decline from 2009 outburst maximum, the star has remained rather stable in color during quiescence, $B-V=+0.22$, $V-R=+0.25$.

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