

ON THE PROGENITOR SYSTEM OF V392 PERSEI

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On 2018 April 29.474 UT Nakamura (2018) reported the discovery of a new transient, TCP J04432130+4721280, at $m = 6.2$ within the constellation of Perseus. Follow-up spectroscopy by Leadbeater (2018) and Wagner et al. (2018) independently verified the transient as a nova eruption in the ‘Fe II curtain’ phase; suggesting that the eruption was discovered before peak. Buczynski (2018) reported that the nova peaked on April 29.904 with $m = 5.6$. Nakamura (2018) noted that TCP J04432130+4721280 is spatially coincident with the proposed Z Camelopardalis type dwarf nova (DN) V392 Persei (see Downes & Shara 1993). V392 Per is therefore among just a handful of DNe to subsequently undergo a nova eruption (see, e.g., Mróz et al. 2016).

The AAVSO¹ 2004–2018 light curve for V392 Per indicates a quiescent system with $V \sim 16$ –17 mag, punctuated with three of four DN outbursts, the last in 2016. Downes & Shara (1993) recorded a quiescent range of $15.0 \leq m_{\text{pg}} \leq 17.5$, Zwitter & Munari (1994) reported a magnitude limit of $V > 17$. These observations suggest an eruption amplitude of $\lesssim 12$ magnitudes, which could indicate the presence of an evolved donor in the system.

The eruption spectroscopy indicated relatively high ejecta velocities ($\sim 5000 \text{ km s}^{-1}$) for a classical nova (CN), with the H α profile possibly containing extended – even higher velocity – emission around the central peak (see the spectrum contained within Wagner et al. 2018). Such high velocities, coupled with a low eruption amplitude, and also the prompt post-eruption detection of γ -ray emission (Li et al. 2018), are features one might expect to see from a recurrent nova (RN), particularly one within a symbiotic binary.

The following photometry of the quiescent V392 Per is contained within the 2MASS All-Sky Catalog of Point Sources (Cutri et al. 2003) and WISE All-Sky Source Catalog (Cutri et al. 2012): $J = 13.766 \pm 0.031$, $H = 13.290 \pm 0.038$, $K_S = 13.062 \pm 0.037$, $w1 = 12.878 \pm 0.030$ ($3.3 \mu\text{m}$), $w2 = 12.761 \pm 0.032$ ($4.6 \mu\text{m}$), the system was not detected in WISE bands 3 and 4 (12 and $22 \mu\text{m}$).

Gaia Data Release 2 (DR2; Gaia Collaboration et al. 2016, 2018) contains a parallax measurement for V392 Per of $0.442 \pm 0.053 \text{ mas}$, which *could* indicate a distance of $3.9^{+1.0}_{-0.6} \text{ kpc}$. We note the caveats regarding DR2 distance determinations (see Lindegren et al. 2018), particularly those regarding unresolved binary systems. The 3D dust maps of Green et al. (2015, 2018) yield a reddening of $E_{B-V} = 0.9 \pm 0.1$ over the Gaia distance range. Taking both this distance and reddening at face value, the absolute magnitude of the eruption could have reached $M_V = -9.5^{+0.8}_{-0.7}$ (or $-10.1^{+0.8}_{-0.7}$ assuming a peak of $m_V = 5.6$) – in either case, this could be inherently a very luminous eruption.

Figure 1 shows the quiescent spectral energy distribution (SED) of V392 Per using WISE and 2MASS data, the Gaia distance, and extinction as above. The quiescent SED is compared to the RNe RS Ophiuchi, T Coronae Borealis, M31N 2008-12a, and U Scorpii, and that of the CN, DN, and intermediate polar, GK Persei, using data within Darnley et al. (2012, 2017) and Evans et al. (2014). We utilise the Gaia distances for all objects (except U Sco and M31N 2008-12a), these are consistent with those recorded in Darnley et al. (2012). As noted by Evans et al. (2014), the WISE photometry of U Sco may be affected by strong emission lines and therefore is not included.

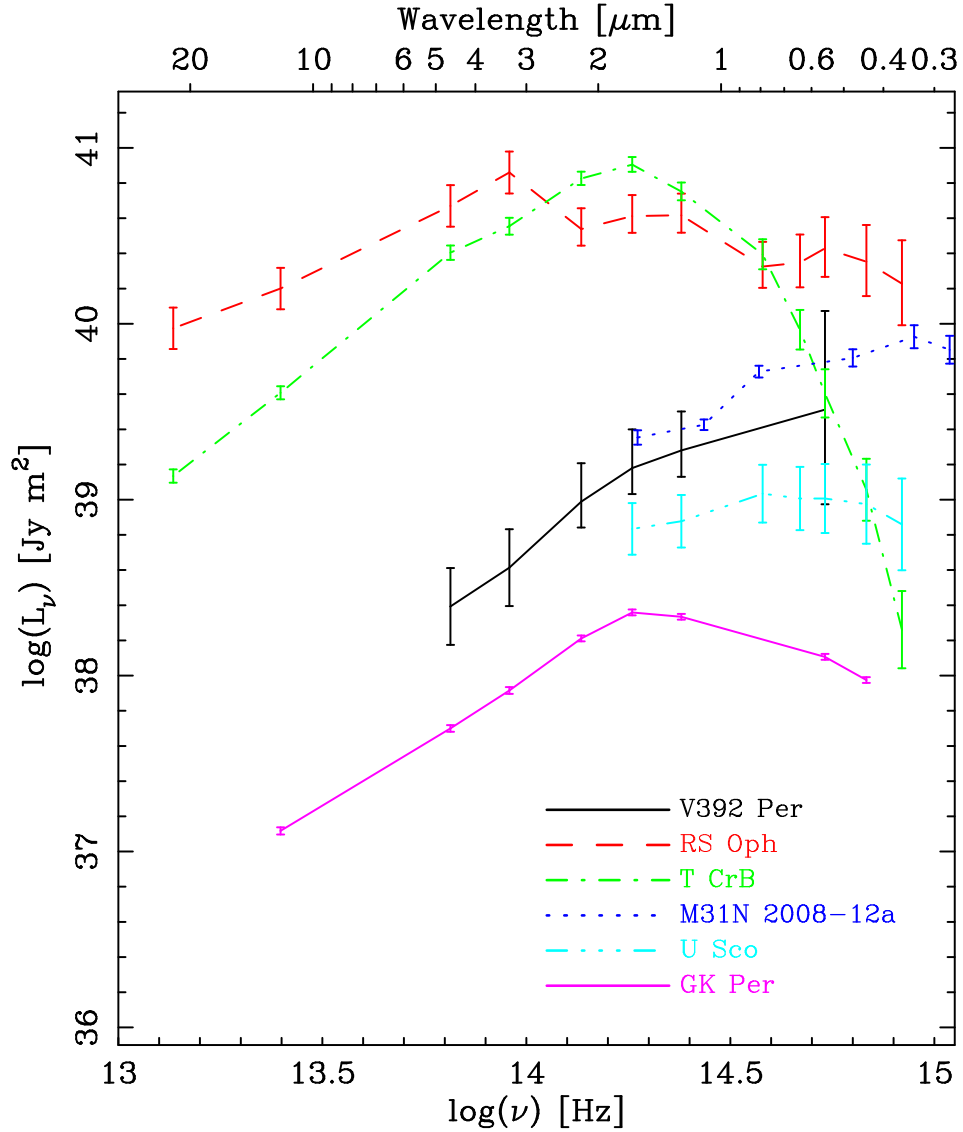


Figure 1. Distance and extinction corrected quiescent SEDs of V392 Per, RS Oph, T CrB, M31N 2008-12a, U Sco, and GK Per. The error bars include photometric, distance, and extinction uncertainties. The lines are to aid the reader.

In conclusion, even after correcting for the large *Gaia* distance and the large extinction, the SED of the V392 Per progenitor is not consistent with the system containing a red giant/symbiotic donor. However, the SED appears similar to those of U Sco and GK Per, a RN and CN, respectively, which contain sub-giant donors, or even that of M31N 2008-12a with its proposed low luminosity giant or ‘red clump’ donor. V392 Per is unlikely to be more distant than implied by *Gaia* – but if significantly closer, the photometry could be consistent with a main sequence donor.

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