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Nova TCP J20210770+2914093 turns into an FeII-type as it keeps rising in brightness

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14793 Spectroscopic classification of TCP J20210770+2914093 as a nova

The transient TCP J20210770+2914093 was discovered by K. Itagaki on 2021 Jul 16.492 UT at unfiltered magnitude 12.0, and classified as a nova by Munari et al. (ATel #14793) based on a spectrum taken on July 17.102 UT.

This initial spectrum resembled novae of the He/N type, with Balmer, HeI, and NII lines present in emission. However, Munari et al. (ATel #14793) warned that with the nova possibly still progressing toward maximum light, the spectral type could evolve toward the FeII type. This has been indeed what happened and here we report about the evolution of the nova during the last two weeks.

We have been monitoring the nova at daily cadence in BVRI bands with various ANS Collaboration telescopes, primarily ID 1205, 2202, 2203, and 3600. After an initial decline of 0.7mag to a minimum brightness reached around July 18.8/19.0 UT (two and a half days past discovery), the nova has since then steadily rised in brightness, being now two mag brighter than the initial minimum. The following are excerpts at representative dates from our monitoring:

July 2021 (UT)	B	V	R	I
16.877	13.087	12.395	11.706	11.126
18.897	13.752	13.111	12.410	11.925
22.929	13.220	12.447	11.786	11.162
28.939	11.828	11.088	10.514	9.956

Spectra of TCP J20210770+2914093 have been collected at various dates with various instruments, in particular on July 18.944 and 28.942 UT with the Echelle spectrograph

mounted on the Asiago 1.82m telescope (range 3650-7350 Ang, resolving power 20,000).

The Echelle spectrum for Jul 18.944 UT coincides with the initial photometric minimum; compared with the spectrum for July 17.102 UT from ATel #14793, it still shows the HeI and NII emission lines although at a much reduced intensity, while the FWHM of Balmer lines has sharpened from 1700 to 1400 km/s and the velocity of Balmer P-Cyg absorption reduced from -810 to -380 km/s (for Hbeta).

In the Echelle spectrum for July 28.942 UT, all HeI and NII features are gone, to be replaced by a forest of strong FeII lines (in particular multiples 27, 28, 37, 38, 42, 48, 49, 55, and 74) all flanked by deep P-Cyg absorptions as for the Balmer lines. This spectrum is a textbook example for a nova of the FeII-type. The typical radial velocity of P-Cyg absorptions is -230 km/s, and the FWHM of the emissions is around 240 km/s. To be resolved, such low velocities requires the high-resolution provided by an Echelle spectrograph.

It is not yet clear what is the reddening affecting the nova. The profile of interstellar CaII 3934, 3968 and NaI 5890, 5896, at heliocentric velocity -7.5 km/s, is the blend of at least two unresolved components. These atomic lines are saturated and cannot be used to derive the reddening except to place a lower limit of ~0.5 to E(B-V). The equivalent width of DIB 6614 is 0.23 Ang; combined with the calibration by Munari (2014, ASPC 490, 183) it returns E(B-V)=1.0 which agrees with value inferred from the IPHAS 3D map of Galactic extinction (Sales et al. 2014, MNRAS 443, 2907). On the other hand, comparing the intrinsic colors of novae at maximum from van den Bergh and Younger (1987 A&AS, 70, 125) with photometry in the table above, a value E(B-V)=0.5 is obtained, which is consistent with the prediction from the 3D maps of Galactic extinction by Lallement et al (2014, A&A, 561) and Green et al. (2019, ApJ 887, 93).

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