SPECTROSCOPIC OBSERVATIONS OF OLD NOVAE

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This communication gives some preliminary results of a spectroscopic survey of old novae presently carried out at Asiago Observatory. I have obtained image-tube spectra of 10 old novae in the spectral range 4000-7000 Å with dispersions from 60 to 180 Å/mm. The observed novae are: T Aur 1891, V 476 Cyg 1920, Q Cyg 1876, HR Del 1967, DN Gem 1912, DQ Her 1934, V 533 Her 1963, CP Lac 1936, V 841 Oph 1848 and GK Per 1901.

Nova Her 1963 has been observed from 1967 to 1976 during its late decline. In 1967, when the nova was 1.5 magnitudes above minimum, the nebular lines of [OIII] were still the brightest lines in the spectrum. The relative velocity of expansion derived from half-width bands was 600 Km/sec. H_β was fainter than HeII 4686. In 1969 the nebular emissions were barely visible and the HeII emission somewhat weakened. At minimum (14.0 mag.), in 1976, HeII bright line appeared fainter than H_β while the nebular lines were no longer visible. The spectral evolution of nova Her 1963 resembles that of nova Aql 1918 (McLaughlin 1953). In both cases the last decline was accompanied by decreasing excitation.

All of the novae here observed have spectra characterised by a continuum well extended in the ultraviolet and broad hydrogen emissions. Particularly, T Aur, HR Del, DQ Her, V 533 Her, DN Gem, CP Lac and GK Per show emissions of HeII at λ 4686 and of HeI at λλ 4922,5875 whose intensities sometimes change with time. An emission feature centered at λ 4648 has been observed in T Aur, HR Del, DQ Her, V 533 Her, CP Lac and GK Per and is probably due to a blend of high excitation NIII and CIII lines. Spectra of nova Q Cyg show weak and sharp emissions of hydrogen and HeI while V 476 Cyg and the very old nova V 841 Oph present only weak hydrogen emissions.

The present observations, when compared with the data reported in the literature (Humason 1938, McLaughlin 1953, Greenstein 1960, Kraft 1964), indicate that the variability of the degree of excitation represents a general characteristic of the post nova spectrum. This phenomenon has been better observed in the spectra of GK Per where the equivalent widths ratios W(4686)/W(4861) and W(4922)/W(4861) vary from 2 to 0.6 and, respectively, from 0.2 to 0.4 on a time scale of one day. In

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all cases hydrogen lines present a double emission profile the shortward half being the stronger. This structure, which is entirely lacking at 4686 HeII, was tentatively regarded by McLaughlin (1953) as due to absorption depressing the shortward edge of hydrogen emission. Particularly large variations of HeII emission intensity have been also observed in novae T Aur, DN Gem, DQ Her and CP Lac.

The weakening of the high excitation emissions in DQ Her is correlated with the orbital motion, derived from the periodic occulations of the hot component (Kraft 1959). The observed variability of the HeII bright line in the eclipsing binary nova T Aur could also be attributed to a similar effect. Two spectra taken at orbital phase 0.86 (near the maximum visibility of the hot spot) and at phase 0.96 (when the hot star is eclipsed) seem to reproduce the phenomenon observed in DQ Her but further observations would be necessary to better ascertain this fact.

Finally, the present investigation has shown that the properties of the spectra of novae at minimum apparently are not correlated with the characteristics of the explosion and the absolute magnitudes. Spectra of slow and fast novae at minimum are sensibly alike. Moreover, although the absolute magnitudes of novae at minimum vary within large ranges (from +2 to +9), as shown in the Amplitude-Luminosity diagram which will be discussed in a forthcoming paper, the corresponding spectra do not show appreciable differences. This point will be further investigated.

References:

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Humason, M.L.: 1938, Astrophys. J. 88, 228.

Kraft, R.P.: 1959, Astrophys. J. 130, 110.

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Mc Laughlin, D.B.: 1953, Astrophys. J. 117, 279.

D I S C U S S I O N of the paper by BIANCHINI:

WYCKOFF: Do your spectra in the red region show any evidence for a cool stellar companion?

BIANCHINI: No, I have got no evidence for absorption features from the cool companion. Possibly the infrared region up to 1 μ (covered by the S1 image tube) would be fruitfull in this respect. Continuum energy distribution measurements are also planned.

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