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INTERSTELLAR LINES IN THE SPECTRUM OF NOVA DN GEMINORUM (1912)

Distance determinations of novae are fairly scarce and often inaccurate. A rediscussion of existing material is especially rewarding for those old novae, whose spectroscopic and photometric history is thoroughly investigated, whose distances, however, could not be obtained because of lack of observable expanding shells. Since the nature of the "stationary calcium lines" was not yet clearly established, their distances were not (or only later) estimated from the strength of the interstellar lines.

The intensity of the interstellar lines in nova DN Gem was obviously never quantitatively studied, as noted by McLaughlin (1965), while extensive discussions of the spectroscopic and photometric evolution were published by Stratton (1920) and McLaughlin (1965).

We have used tracings of the spectra Nos. 1865, 1867, 1870, and 1873 obtained by F. Küstner with the Bonn 0.30 m refractor and the Toepfer 3-prism spectrograph in March and April, 1912. The photometric calibration was established by measuring the strength of different iron arc comparison lines belonging to the same multiplet, as proposed by Hogg (1929). While the Ca II K line was always weakly exposed, the Ca II H line was clearly seen and measured against the broad, diffuse Hε + Ca II H emission. Since the distance relations are always given for the Ca II K line strength only, a conversion factor 1.78 (Binnendijk 1952) was applied:

$$W_K = 1.78\ W_H$$
$$= 0.165\ \text{Å}$$
$$\pm .022\ \text{m.e.}$$

Using distance relations by Allen (1973), Beals and Oke (1953), and Binnendijk (1952), a distance

$$d = 450 \pm 70\ \text{pc}$$

is obtained. Taking into account the inaccuracies of the distance and the plate calibrations, the error is probably twice as high.

The method of the residual radial velocity of the interstellar lines, interpreted as being due to differential galactic rotation, and successfully applied by McLaughlin (1941) to three novae, yields in the case of DN Gem (r.v.helioc. of Ca II = + 4.8 km/s; McLaughlin, 1965):

$$v_r = - 14.7 \text{ km/s}$$

This value indicates a distance of the order of 10 kpc, which cannot be reconciled with the observed strength of the interstellar lines, and the known absolute magnitude range of galactic novae - a fact which obviously prevented McLaughlin from applying his 1941 method in his 1965 study on DN Gem. The observed residual radial velocity must be interpreted as being due to the peculiar motion of interstellar Ca II in the direction of DN Gem.

Thus we will rely only on the distance determination by the inferred strength of the Ca II K line. Interstellar absorption may be estimated by using the studies of Neckel (1967), Gottlieb and Upson (1969), and Deutschman et al. (1976). For a distance of 450 pc,

$$A_V = 0.27 \pm 0.13$$

DN Gem reached $m_{pg} = 3.6$ at maximum light. Assuming $C_o = 0.25$ around maximum light, an absolute visual magnitude

$$M_V = - 5.3 \pm 0.5$$

is derived. While it is possible that the absolute magnitude, due to the many uncertainties entering the calculations, may be as high as -6.5, the estimates of -7.2 ... -7.6 given by McLaughlin are certainly too high.

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