
ABSTRACTS***Bappu, M. K. Vainu. The variation of emission-line intensities in CQ Cephei.**

The binary nature of the Wolf-Rayet star HD 214419 was first noted by McLaughlin and Hiltner,¹ at Michigan in 1941. Shortly thereafter Gaposchkin² showed the star to be an eclipsing system with two well-defined minima. Hiltner³ recently studied the system photoelectrically and obtained light-curves in the ultraviolet and yellow regions of the spectrum as well as a light

curve of the emission line 4686A of $HeII$. The variation of 4686 differed from that of the integrated case in that it had maxima at conjunctions and minima at elongations, or in other words the geometry of the system is such that 4686 is most intense when either star is eclipsed.

To determine whether other lines of $HeII$ and

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those of nitrogen have a variation with phase similar to that of 4686A, spectra were taken throughout the 1.64 day period and central intensities, corrected for the eclipse of the continuum, determined. The $HeII$ lines $\lambda 4861$, $\lambda 4542$, $\lambda 4026$, were eclipsed at both primary and secondary minima, with the intensity of emission outside eclipse immediately after primary minimum, lower than the intensity at third quadrature.

The lines of nitrogen, $NIII$ 4528, NIV 4058, NV 4603, have a variation with phase similar to $HeII$ 4861, but the intensity at first quadrature is greater than at third quadrature. There is slight evidence that the depths of primary minima are different for $NIII$, NIV and NV , in that NV has the smallest depth and $NIII$ the largest, but the material analyzed so far is very little to establish this definitely. However, if this is real, it shows that NV is less eclipsed compared to the $NIII$ zone. From geometrical considerations, it is possible that NV is present in a higher layer of the atmosphere than $NIII$, or in other words a positive excitation gradient is present in the atmosphere.

The presence of a secondary minimum in the light curves of $HeII$ 4861, NIV 4058 and other lines of nitrogen indicates that a fair contribution to the overall emission comes from a region in between the two stars. The differences between the intensities at first and third quadratures may be explained as due to the asymmetric distribution of the emission.

If one assumes that the system of CQ Cephei is a very close binary with a common envelope in which 4686A is excited, the light curve can be explained as due to the changes in the degree of occultation of this emission envelope. In such a picture more of the envelope is occulted at first and third quadratures than at times of primary and secondary minima. But as the other $HeII$ lines are not present so far out from the center of mass of the system, it is possible that a fluorescence mechanism involving Lyman α , as Bowen⁴ has suggested, is responsible for the excitation of 4686A. If so the light-curve of $HeII$ 3203 should be identical to those of $HeII$ 4861, and NIV 4058, and hence a study of its variation in this eclipsing system would be valuable.

1. *Pub. A.S.P.* 53, 328, 1941.

2. *Ap. J.* 100, 242, 1944.

3. *Ap. J.* 112, 477, 1950.

4. *Ap. J.* 85, 1, 1935.