OBSERVATIONS OF MASS FLOW, DISKS, AND ACCRETION PROCESSES IN ALGOL BINARY SYSTEMS

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As part of a multi-faceted study of gas streams, disks, and accretion processes in Algol type binaries, R.S. Polidan and I have obtained high resolution IUE observations of seven systems. Perhaps one of the most interesting results from these observations was the discovery of strong, variable absorption lines of N V, C IV, and Si IV in the spectra of stars whose photospheres are much too cool to form these ions. N V (1239,1243) and C IV (1548,1551) have been observed in AU Mon (B5V, $11\overset{d}{.}1$), CX Dra (B3V, $6\overset{d}{.}7$), and U CrB (B4V, $3\overset{d}{.}5$) while Si IV (1394, 1403) was found in TX UMa (B8V, $3\overset{d}{.}1$). The systems in which these ions have been observed generally contain primaries whose dimensions are greater than the Lubow and Shu (1975) parameter ϖ_{min}.

Radial velocity measurements of the N V, C IV, and Si IV features suggest that the line formation region is associated with the primary star and small in size. The strengths of the N V, C IV features appear to be variable on a time scale of several orbital periods and may be determined by the instantaneous rate of mass transfer. However, when the high ionization features are observed, their presence appears to be global and not restricted to the domain of gas stream impact.

Analysis of the N V, C IV features reveals that the line formation region is high in temperature ($T \simeq 125000$ K), low in density ($N_H < 10^9$ cm^{-3}), small in size ($h < 1 R_\odot$), turbulent ($75 < b < 130$ km s^{-1}), and nitrogen rich ($\simeq$ ten times the solar value). Quite striking is the N V line width in U CrB where the analysis shows $b \simeq 120$ km s^{-1} while the star's rotational velocity is 60 km s^{-1}. Thus we have found evidence of a turbulent accretion region composed of processed material in some Algol binary systems. A decade ago, Batten (1970) suggested the presence of three components (stream, disk, cloud) to the circumstellar matter in Algol type mass transfer binary systems. We further suggest that the turbulent accretion region is an important fourth component. The results discussed in this summary will be published in a paper submitted to the Astrophysical Journal.

REFERENCES

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