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HD 185510: A CALCIUM-EMISSION BINARY WITH ECLIPSES OF  
A SUBDWARF COMPANION

HD 185510 is a K0 III-IV star with strong Ca II H and K emission (Bidelman and MacConnell 1973). It is a light variable with a photometric period of approximately 25 days (Henry, Murray, and Hall 1982). Radial velocities and photometry obtained at SAAO (Balona, Lloyd Evans, and Koen: to be published in SAAO Circulars) yield an orbital period of 20.658 days and an improved photometric period of 25.4 days. The secondary star is a B subdwarf (Fekel and Simon 1985), which is eclipsed at phase 0.40 in the orbital ephemeris using  $T = 2,440,000.0$ . The eclipse of the hot star is prominent in U - B (see Fig. 1), but is much smaller in B - V (depth of 0.02 to 0.03 mag). At these longer wavelengths the eclipse variations are dominated by starspot activity on the primary star.

**HD185510 ORBITAL PERIOD 20.658**

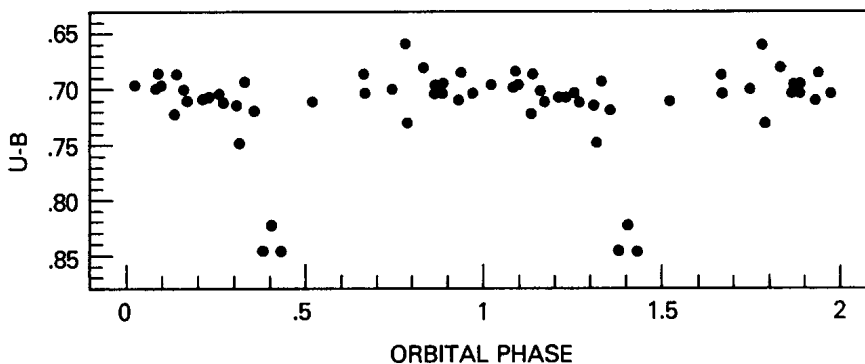


Fig. 1. Photometry of HD 185510 from the SAAO. Zero phase corresponds to JD 2,440,000.0.

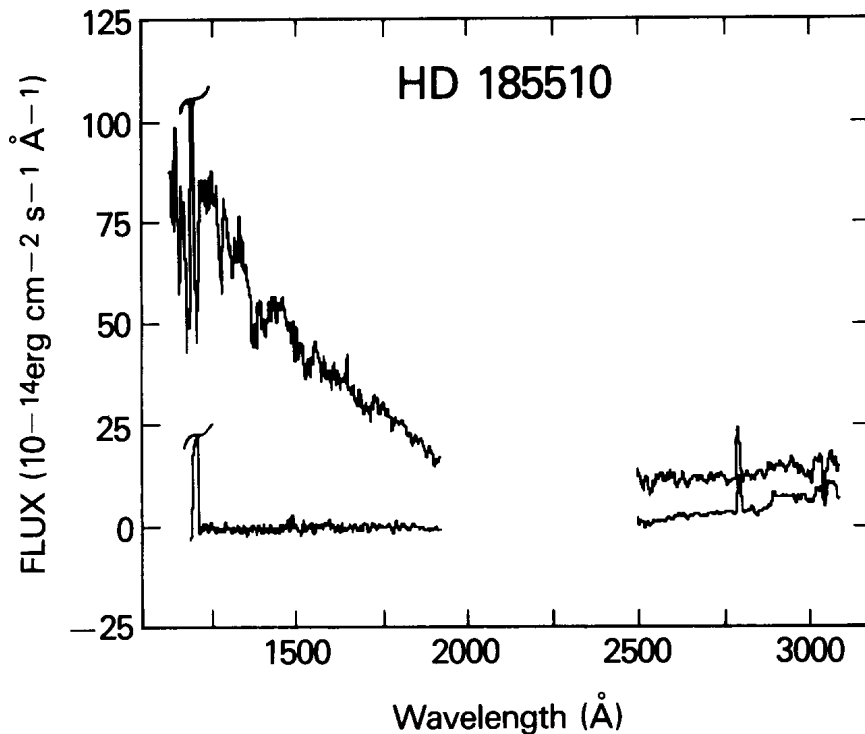


Fig. 2. Low dispersion spectra of HD 185510 obtained with the ultraviolet cameras of IUE. The bright out-of-eclipse spectrum of the hot subdwarf is present in the upper curve, but there is no trace of this star in the lower spectrum, which was taken when the subdwarf was eclipsed by the primary. In both observations the Lyman-alpha line is contaminated by geocoronal emission and has been clipped. We identify the Mg II emission line in the long-wavelength region with the chromosphere of the late-type primary.

At far ultraviolet wavelengths the eclipse of the secondary star appears to be total. Fig. 2 shows a recent out-of-eclipse spectrum of the subdwarf that we obtained with the IUE satellite on JD 2,446,713.42 (corresponding to phase 0.98) and a follow-up observation made with the same exposure time on JD 2,446,742.69 at the time of secondary eclipse. The total eclipse of the subdwarf in the later observation is unmistakable. A third spectrum was kindly taken for us by Dr. Chris Shrader of the IUE Observatory staff on JD 2,446,370.67 during ingress when the subdwarf was not fully occulted. This observation appears to show atmospheric eclipse effects due to the extended chromosphere and transition region of the primary star.

Ground-based observations of HD 185510 in the current observing season were resumed at the SAAO in April 1987. Radial velocity observations show no significant error in the orbital ephemeris, but an uncertainty of several hours cannot be excluded as the semi-amplitude,  $K$ , of the velocity curve is only  $9.6 \text{ km s}^{-1}$ . Photometry near the time of the eclipses of April 1-2 and April 22 showed no fading in  $U$  at 0.7627 and 0.3720 days, respectively, before the predicted dates of mid-eclipse. Therefore, the phase of mid-eclipse may be somewhat later than 0.40. The range of the 25-day photometric light wave in  $V$  is now 8.26 to 8.45 mag, which is 0.05 mag brighter overall than in 1979-81. This suggests that the spots on the K star have evolved since the earlier observations.

Observations of HD 185510 from the SAAO are continuing. In addition, IUE observations during the ingress and egress phases of the eclipse predicted for 1987 October 25 are planned to study the atmospheric structure of the K star. Additional photometry of HD 185510 from other observatories at a range of longitude would be most valuable, as a complete eclipse curve is needed to interpret the spectroscopic data. Observations should cover the hours before and after the photospheric eclipse when the atmospheric eclipse will take place. Measurements at  $U$  and  $B$  are most important for this purpose. Observations at longer wavelengths (in  $V$ ,  $R$ , and  $I$ ) would also be useful for establishing the location and geometry of the starspots on the active primary star. The preferred local standard is HD 185587,  $V = 9.089$ ,  $B - V = +0.182$  and  $U - B = -0.019$ , which lies 7 arcmin ESE. HD 185567, which is 8 arcmin SE of HD 185510 and is a better match in color and magnitude, may be variable (Lloyd Evans, Koen, and Hultzer 1983).

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