present complete, B, V light curves obtained from observations made on 1988 June 10, 12, 13 and 15 with the facilities at Lowell Observatory. We also present three newly determined epochs of minimum light and discuss the apparent period increase as indicated by all available observations. An improved ephemeris is calculated based on photoelectric data only.

4.06
Structure of the Wind from the Massive X-ray Binary 4U 1700-37
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High dispersion IUE spectra and archival Einstein X-ray measures are used to probe the gas flow in the massive x-ray binary 4U 1700-37 = HD 153919. UV spectra yield new radial velocity curves for the binary which are in good agreement with curves determined previously from visible-band spectra. These radial velocity curves show marginal evidence of mass loss enhancements from the inner and outer edges of the O star primary, indicating that the O star underfills its Roche Lobe. Re-examination of the mass function of the binary and the duration of the x-ray eclipse indicates that the primary is 25% more massive and the binary separation is 40% larger than previously believed, and that the half-angle duration of the x-ray eclipse must be 30° or less. The mass of the neutron star is $M = 1.7 M_\odot$ if the orbital inclination is near 90°. Variation of the unwarped N IV $\lambda 1640$ feature (previously reported by Howarth, Hamannschlag-Resenbege and Kallman 1986) reveals the existence of a substantial ($\sim 1.1 R_\odot$) region around the neutron star in which x-ray photoionization removes N IV absorbers from the line of sight. Analysis of the effects of the ionization cavity on the wind structure shows that the wind acceleration parameter $f$ is close to 1. Variability of the unwarped x-ray features in the spectrum (e.g. He II $\lambda 1640$) indicates the presence of an extended stream of material trailing behind the neutron star secondary and co-rotating with the binary. This stream accelerates more slowly than the bulk wind ($f_{\text{mean}} \sim 2.0$) and probably results from the interaction of the accelerating wind material with the non-accelerating photo-ionized material close to the neutron star. X-ray flux variations occur randomly on timescales of tens of minutes. If these variations are produced by wind inhomogeneities, they indicate a size of $\sim 1 R_\odot$ for a typical blob.

References

4.07
Solar Activity on RS CVn Stars: An Integrated Approach
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The paradigm for explaining solar activity in RS CVn binary systems is enhanced forms of solar activity. The high-activity regions have large area coverage, typically 10% to 50% of the stellar surface. The spectroscopy group at Penn State has been monitoring selected RS CVn systems with a Fiber-Optic Echelle (FOE) at KPMO. This instrument allows a resolution of 10000 and wavelength coverage from 3900 Â through 9200 Â. To aid in the interpretation of these data we have begun a program at Penn State of solar spectroscopy with a format identical to the FOE at KPMO. The sun is observed with very low spatial resolution (the aperture is 27 arcsec), so that the light entering the sampling fiber is a mixture of active and nearby quiet regions. Observations of quiet sun regions well-separated from active regions are also made. Subtraction of a purely quiet region from the active region leaves us with an excess profile. This can then be compared with the results of a similar procedure we use on active stars, in which the spectrum of an inactive star is subtracted from that of the active star under study. The 6" f/10 refracting guide telescope of the 1.6m at BMO is used to feed the spectrograph and TV guiding system. Guiding is performed with the fiber-aperture superposed on the solar image.

4.08
Three Very Cool Degenerate Stars in Luyten Common Proper Motion Binaries: Implications For the Age of the Galactic Disk
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During the course of a spectroscopic study of Luyten common proper motion binaries we have obtained spectrophotometric data of observations of several stars with estimated absolute magnitudes $M(\nu)\sim 16$. Each of the stars consists of a yellow degenerate star primary and a red DCl+ secondary 1.6 to 2.3 magnitudes fainter. One of the primary stars is spectral class D7, another is a sharp-lined DA, and the third shows peculiar broad absorption features which we interpret as pressure-shifted G2 Swan bands. The LP701-69-70 system has survived over 8 billion years without disruption by passing stars, despite its 1500 a.u. orbital major axis. The three cool degenerate companions nearly double the available sample of stars at the low-luminosity terminus of the white dwarf cooling sequence. These findings appear consistent with Winget et al.'s conclusion that degenerate stars in the old disk population have not had time to evolve to a luminosity fainter than $M(\nu)\sim 16$.

4.09
Ultraviolet, Visible, and Radio Observations of EI Eri

We observed EI Eri (= HD 26337) continuously for two orbital cycles with IUE during 16-19 September 1988. Simultaneous observations were obtained at ESO, Catalina, and the VLA. We present the results of the ultraviolet and visible spectroscopy and the visible and radio photometry during this 4 day period. We also discuss the results of a larger program of photometric and spectroscopic monitoring of EI Eri throughout the fall 1988 observing season.

The IUE FES light curve obtained during the first orbital cycle differed markedly from that of the second cycle. The peak-to-peak amplitude of 0.2 mag during this period was much larger than the maximum amplitude during 13-30 September.

Several large ultraviolet flares were observed on 16-17 September. Outside of the flares, the far-ultraviolet line fluxes were relatively constant. The Mg II k line flux, on the other hand, varied dramatically. Like the visible light curve, however, these variations were not the same in both observed cycles. We are using phase-dependent variations in the Mg II k line profile to map the chromospheric structure. It is crucial that we study temporal and phase variations simultaneously before using our data to produce an "image" of the chromosphere. Given the nature of the light curve, it is possible that "Doppler" images cannot be based on a non-continuous data set. Because EI Eri has a period of n/2 days, ground-based data from any single site suffer large phase gaps. In practice, continuous observations require a space-based platform or a network of similarly equipped telescopes that are widely separated in longitude.