

28.16

Evidence of Magnetic Activity and Angular Momentum Loss in VW Cephei

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VW Cep is one of the brightest and longest observed short period ($P = 6.67$ hr) W UMa-type binaries. It consists of G5 and K0 components in contact with their Roche lobe surfaces. VW Cep displays high levels of chromospheric and surface activity which are manifested by strong x-ray emission, CaII H + K and MgII h + k emission, transition region emission, radio emission, and asymmetries in its light curves due to cool starspots. We investigate complex period changes which have occurred based on eclipse timings from the past 60 years. In addition to the well known 30 year light-time effect due to the presence of a third star in the system, we find evidence for a long-term decrease in the orbital period of $dP/dt \sim -2 \times 10^{-2} \text{ sec yr}^{-1}$. This apparent decrease in period suggests that angular momentum is being lost from the system. The light curves of VW Cep undergo significant (~ 0.10 mag) brightness changes with time, most likely due to the presence of starspots. Activity cycles of the order of 7-9 years are suggested from the analyses of the photometric data. We are studying the possible correlation of spot and surface activity with small, second order period changes maybe arising from mass loss in winds and/or mass flow between components.

28.17

Stalking the Migrating Spots and Plages on VW Cephei

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Photoelectric photometry of the 6.67 hr contact binary VW Cep continues at Villanova University to study the activity and migration of two large, cool starspot regions on the larger, cooler star of the system. IUE observations of VW Cep were conducted to search for possible phase dependent variations of the chromospheric and transition region emission lines that could be correlated with the placement of starspots deduced from the light curves. Preliminary IUE observations in April 1987 did suggest a correlation between the visibility of the starspot region and strongest emission line fluxes, but these observations were limited to one orbit which allowed only three SWP spectra to be obtained. During July 1988 VW Cep was observed over two consecutive orbits with IUE and six low-dispersion SWP and eight LWP spectra were obtained. From these spectra the integrated fluxes of the important chromospheric and transition region lines were measured. Light curves of VW Cep obtained in June 1988 were modeled to determine the distribution and extent of the starspot regions. The modeling indicated that the two spots had changed their positions significantly. The new positions of the starspots agreed very well with the locations of the centers of transition region line activity. This implies a physical connection between the photospheric starspots and the overlying transition region emissions. However there were no significant variations in the strengths of the chromospheric MgII feature over the two orbits.

*Guest Investigators with the IUE satellite (NASA)

28.18

The Life and Times of FK Com

H.L. Nations (Franklin and Marshall), D.L. Buzasi, D.P. Huenemoerder, and L.W. Ramsey (Penn State)

A long-term database on H-alpha emission in FK Comae has been collected at Penn State. We consider the behavior exhibited by this line for the seasons of 1981 through 1987. The diagnostics explored include both the total emission equivalent width of the line and the ratio of the heights of the violet to the red peak of the double-peaked H-alpha complex; the latter is known as the V/R ratio. We also show photometry of FK Comae for three seasons and compare and analyze the photometric analysis with respect to the spectroscopy.

The behavior of the star appears to vary drastically from season to season. At times we see excellent correlation

of V/R with phase while the H-alpha equivalent width is essentially constant; in other seasons the reverse holds, and in 1982 a weak correlation with phase is seen for both indicators. Over the long term, the double-peaked H-alpha structure is seen in all seasons, and its net emission level is approximately constant.

A general lack of correlation between V/R and equivalent width in H-alpha is observed; this leads us to believe that multiple emission regions exist which are not co-spatial. These groups include a density inhomogeneity which is corotating with the star and is responsible for the V/R changes, a "hot" spot responsible for the H-alpha emission, and a cool spot which generates the observed light curve. We see no way to account for the observed V/R variations and the tremendous width of the H-alpha emission without postulating corotating material at high altitudes.

28.19

Flashes from Normal Stars

B.E. Schaefer (NASA/GSFC)

A substantial amount of evidence has accumulated to support the possibility that normal stars can undergo large amplitude flashes on timescales from one to several thousand seconds. This evidence consists of flashes observed on 24 normal stars as well as 141 flashes on field stars observed by Johnson. These stars are 'normal' in that they are not late type dwarf stars and have no particularly exotic characteristic other than the flash. This includes three flashes from G-type dwarf stars. The flashes have amplitudes ranging up to >7 magnitudes involving energies $>10^{40}$ ergs. It is possible that these flashes are evidence for a rare class of previously unknown phenomena. If so, then an 'average' star undergoes a flash every century or so, although our Sun must have a much longer recurrence timescale. The available evidence is not conclusive that something new is going on, but it is more than adequate to show that the topic of 'flashes on normal stars' can not be dismissed.

28.20

Dust in the circumstellar environment of AG Carinae: evidence for a bipolar and helical structure

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Coronagraphic observations of the immediate surroundings of the galactic Luminous Blue Variable AG Carinae in the broad band filters B, V, R, I, have led to the detection of a highly anisotropic continuum emission at intensity levels in the range $m_v = 17.9-19.4 \text{ mag/arcsec}^2$. A prominent bipolar structure is observed, elongated along the NE-SW direction from a few arcsecs to ≈ 15 arcsecs from the star, corresponding to a projected linear distance of ≈ 0.5 parsecs. The morphology of the SW extension is peculiar in that it seems to consist of two thick helical filaments. Its essentially neutral color with respect to the star ($\Delta(V-I) = -0.04 \pm 0.2$) suggests that the observed radiation is starlight scattered by dust grains of size larger than 1μ . Both the bipolar and helical structure might be most naturally explained by outflow from a small secondary component in a close binary system and the precession of an associated accretion disk.

TUESDAY