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OU Gem AND AT Cap IN 1984/5

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We present broadband photometry and high-dispersion spectroscopy of OU Gem (HD 45088), and spectroscopy of AT Cap (HD 195040). These data are relatively limited in number, but may be of use when compiling a longer term history of the stars' behaviour.

OU Gem:
Broadband differential photometry of OU Gem (V$\sim$7) was obtained with the 0.4-m and 0.6-m telescopes at Siding Spring Observatory (SSO) in 1985 February 05-11, while simultaneous spectroscopic observations (resolution $\sim$ 0.2 Å) were made of the Ca K emission line using the 1.0-m SSO telescope. Table 1 lists the photometry, in the V band only, relative to the comparison stars. Two, three or four observations were made each night, obtained over one or two hours - the table lists nightly means, timed to the nearest 0.05 d. At this time, OU Gem showed no variation in the V band above observational error (Figure 1). The light curve is known to be of variable amplitude. Bopp et al. (1981) observed a V range from $\sim$0.02 to 0.045 magnitude over 6 months in 1980. A similar range in amplitude has been observed by Cutispoto (1991, 1992, 1996), and Rodono and Cutispoto (1992). Hence our observations appear to have been made at a time of low activity.

Table 1 – V Photometry of OU Gem, 1985 Feb 05-11. (CS1=HD 45452, CS2=HD 45413)

HJD−244000	OU Gem - CS1	OU Gem - CS2	CS1-CS2
6102.05	−0.947	−1.073	−0.126
6103.10	−0.946	−1.062	−0.117
6105.06	−0.950	−1.063	−0.113
6106.10	−0.948	−1.054	−0.107
6107.10	−0.940	−1.044	−0.105
6108.05	−0.950	−1.074	−0.125
Mean	−0.947	−1.062	−0.116
Std dev	0.003	0.0100	0.008

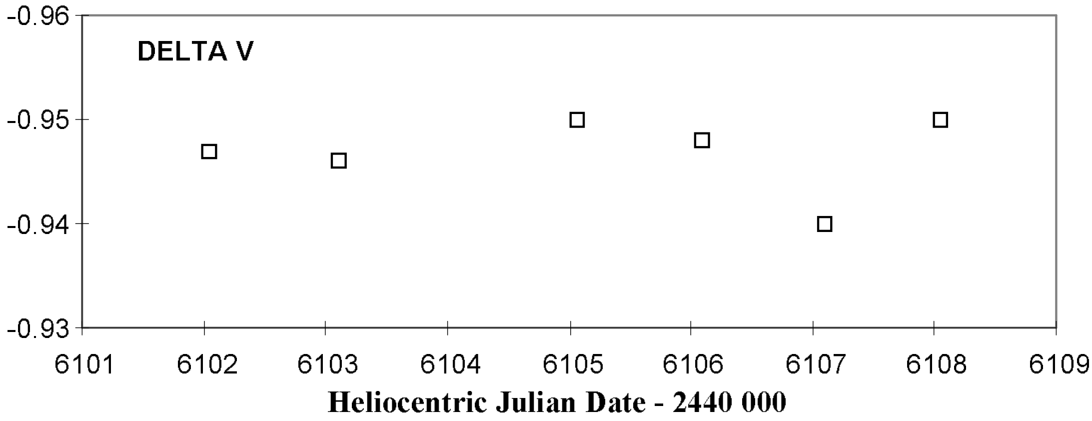

Figure 1. V Photometry of OU Gem - 1985 February

Nightly spectra of the Ca K region of OU Gem were obtained on seven nights in the interval 1985 February 05-12. (February 7 was cloudy.) Emission cores from both components were visible, as noted by Bopp (1980). The secondary emission is weaker than that of the primary, but as the secondary spectrum is otherwise invisible in our (blue) spectra the secondary emission is much stronger (relative to its continuum) than for the primary. The secondary emission may have decreased between the 1979 observations of Bopp (1980) and our 1985 data, which together with the lack of variation in our photometric data may suggest the secondary star is the source of the light variations seen by others.

Radial velocities were derived from cross correlations on the primary spectrum absorption lines, using template stars of known radial velocity, and also from least squares gaussian fits to the primary and secondary emission cores. See Innis et al. (1988) for more details of these procedures. Our measurements listed in Table 2. On one night the primary and secondary K emission cores overlapped; the velocity measured agreed with the cross correlation result from the primary's absorption lines. The radial velocity variation of this star has been well studied by Griffin and Emerson (1975) and Tomkin (1980). Plotting our data with the elements determined by Griffin and Emerson (1975) gives a good fit between our data and the earlier sets (see Figure 2, where we use P = 6.991868 d, Epoch = HJD 2440203.163 from Griffin and Emerson, 1975). Four more recent radial velocity measurements presented by Gunn et al. (1996) are also satisfactorily described by these elements, implying no revision is required.

Table 2 – Spectroscopic data for OU Gem, 1985 February 05-12.
Heliocentric Radial Velocity (km s^{-1})

HJD − 2440000	Cross Correlation	Ca K emission: Primary	Secondary
6101.99	+18.6	+18.7	−52.9
6103.02	+42.2	+44.6	−81.2
6105.01	−42.3	−45.4	+22.9
6106.03	−62.0	−66.4	+54.3
6107.05	−44.5	−46.9	+29.2
6108.02	−10.8	−10.9	–
6109.01	+25.5	+24.6	−51.1

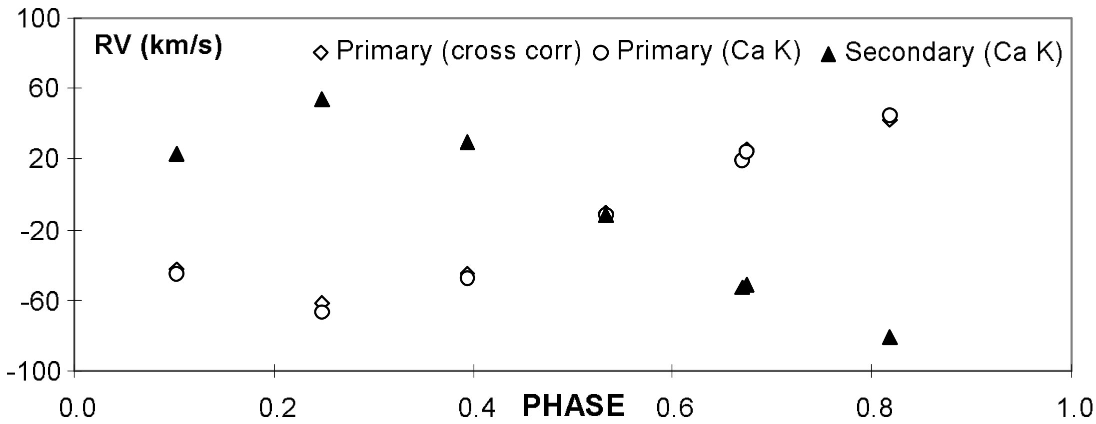

Figure 2. Radial velocity versus orbital phase for OU Gem

AT Cap

Balona (1987) presented 35 radial velocity observations of this single-lined binary, deriving an orbital period of 23.206±0.018 days, with a velocity semi-amplitude of 21.9 km s^{-1}. Collier (1987) obtained nine observations of this star, also demonstrating velocity variability. Lloyd Evans and Koen (1987) reported photometric variability commensurate with the orbital period. We obtained 12 radial velocity observations of AT Cap, mostly around 3 years after the Balona and Collier data, from cross correlation on the star's absorption spectrum. Our measurements are given in Table 3. Performing a Lomb-Scargle periodogram analysis on all 56 measurements of the radial velocity yielded a period of 23.20±0.03 days, which within the error agrees with the finding of Balona (1987), but does not refine the period.

Table 3 – Radial velocity data for AT Cap

HJD − 2440000	Heliocentric Radial Velocity (km s^{-1})
5927.983	−39.9
5928.153	−40.3
5978.966	−25.8
5978.997	−21.5
5979.935	−12.2
5980.053	−16.0
5980.945	−4.4
5981.924	−0.5
5982.917	+3.3
5983.941	+7.2
5985.934	+6.5
6305.063	+6.4

Our data are plotted with the earlier work of Balona (1987) and Collier (1987) in Figure 3, using an epoch = HJD 2444353.1 and P = 23.206 d (Balona, 1987). The velocity curve shows some scatter, but trying slightly different values of the orbital period does not reduce the discrepancies. Five measurements (three of ours, two of Balona's) appear too positive by 10 to 20 km s^{-1} (near phases 0.2, 0.28 and 0.43) for reasons we cannot account for, but which may be due to nothing more significant than observational error together with possible systematic differences between the two data sets.

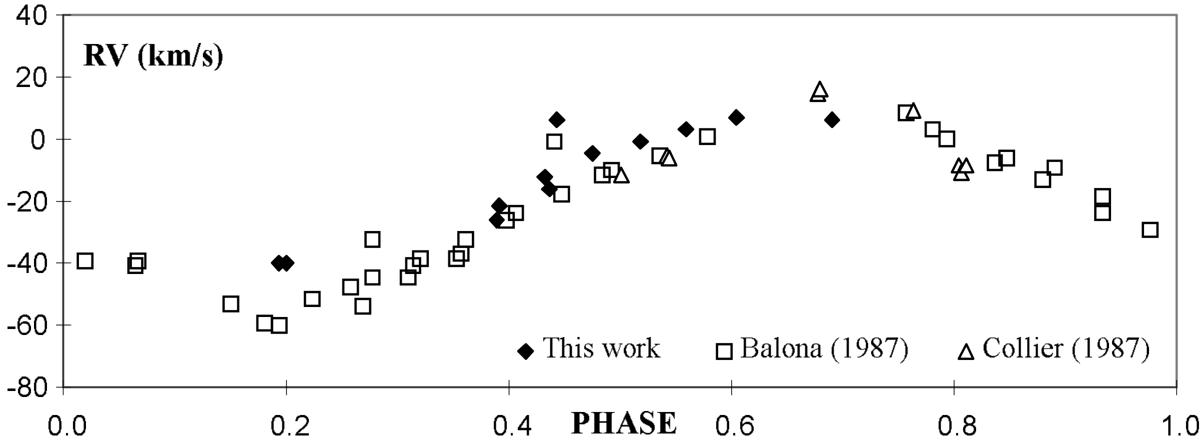

Figure 3. Radial velocity versus phase for AT Cap

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