THE RS CVN PROJECT AT CAPILLA PEAK OBSERVATORY*

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1. INTRODUCTION

The 61-cm telescope at the Capilla Peak Observatory of the University of New Mexico was used extensively from 1979 to 1982 for UBVR observations of selected RS CVn stars. (See Elston and Zeilik, 1982, for details of the system.) Complete coverage was obtained from most of the short-period systems (Hall, 1976)--RT and CG Cyg, XY Uma (the most active of these systems), UV Psc and ER Vul--with a precision of 0.01 mag or better for each datum. Our early experiences showed that these stars had rapid intrinsic variations (within a month).

2. DATA ANALYSIS AND RESULTS

The now-standard model for RS CVn activity (Hall, 1972) posits large spotted regions covering a considerable fraction of the active star's surface. Models to date have usually found that two spotted regions with effective temperatures about 1000 K below that of the photosphere mimic the observed photometric behavior reasonably well (Eaton and Hall, 1979; Poe and Eaton, 1985). Although such models are not unique, they can follow the long-term trends in the evolution of the spotted regions: their positions, areas, and temperatures.

We report here on the first effort to model starspots on the short-period systems using the Capilla Peak database. These time-serial observations are of high-precision, made with a dedicated instrument, and include the R-band essential to finding spot temperatures (which is otherwise a free parameter). We use UV Psc here as a typical example.

We have adopted the methods of Budding (1973, 1977) to fit the binary light curves and the distortion waves in them. The data was fit by an eclipsing binary model for at least 5 geometrical parameters optimized to a minimum chi-squared. Then the theoretical light curve was subtracted from the observed one to leave behind the distortion wave. This wave was modeled by two spots, assumed to be circular and fixed in latitude. We subtracted the computed distortion wave from the original data to leave a "clean" light curve. We finally fit a new binary model

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to find the actual values of the system parameters.

Figure 1 shows a theoretical fit to the V-band data on UV Psc. It gives the distortion-wave model with two spots on the equator. The spotparameters are: spot 1, longitude 190°, size 9.8° , spot 2, longitude 286° , size 11.2° .

Given the results from these preliminary models, we conclude that high-quality photometric data can provide sufficient information for starspot models on RS CVn systems for which the distortion wave has a small amplitude. The photometry must have a precision of at least 0.01 mag (0.007 to 0.005 mag is better) in order to pull the distortion wave out of the eclipsing light curve for meaningful starspot modeling.

REFERENCES

Budding, E., 1973, Astrophys. Space Sci., 22, 87.
Budding, E., 1977, Astrophys. Space Sci., 48, 207.
Eaton, J. A. and Hall, D. S., 1979, Ap. J., 227, 907.
Elston, R. and Zeilik, M., 1982, PASP, 94, 729.
Hall, D. S., 1972, PASP, 87, 323.
Hall, D. S., 1976, in Multiple Periodic Variable Stars, edited by W. S. Fitch (Reidel, Dortrecht), 278.
Poe, C. and Eaton, J. A., 1985, Ap. J., 289, 644.

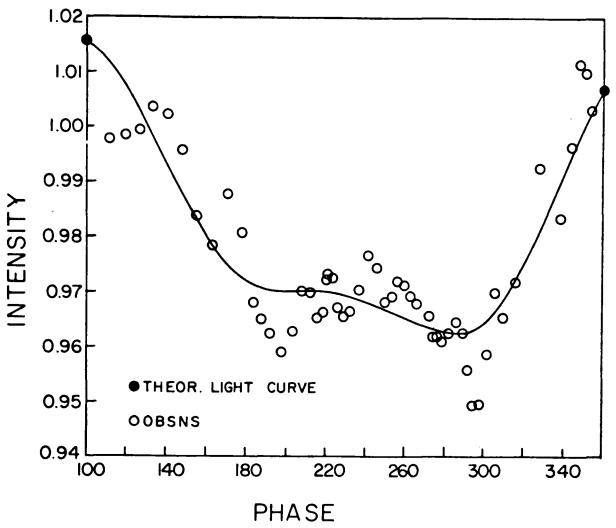

Fig. 1-Two spot fit for UV Psc.

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