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1991 V-Band Photometry of an Eclipsing Binary: 1E 1919+0427

As part of our long-term observing program of chromospherically-active binary stars, we have observed a photometric light curve of the RS CVn candidate 1E 1919+0427 at V-band. The light curve shows that it is an eclipsing system with evidence of a distortion wave.

1E 1919+0427 was discovered to be an x-ray source in 1986 (Takalo, 1986). Takalo and Nousek (1988) investigated the source spectroscopically. They found that it is a double-lined binary system with observed spectral classes G5 V and K0 III - IV, as are typical for an RS CVn. Based on radial velocity measurements, they arrived at an orbital period of 0.8 days.

We observed 1E 1919+0427 on September 25 and 26 and October 4 and 17 of 1991 with the 61-cm telescope at Capilla Peak Observatory equipped with a Photometrics CCD camera (Laubscher et al., 1988). We used this system as a multichannel photometer to sample sky, variable, and the comparison star simultaneously. Our filter set (Beckert and Newberry, 1989) is matched to Johnson at V. Typical exposures were 40 - 50 seconds at V. We used star "B" in figure 1 as a comparison star. Star "C" was used as a check star.

From our photometry, we were able to get precise times for primary and secondary eclipse. With this information we applied

a Lafler-Kinman period search to find the period elements of 1E
1919+0427:

$$JD_{\max} = 2448533.71141 + 0.83414E$$

The V light curve is plotted at the 0.83414 day period in figure 2. This figure shows delta magnitudes in the instrumental system. The statistical error in the observations is about 0.01 mag.

We noted that the star's magnitude as it enters primary eclipse is higher than as it comes out of eclipse -- evidence of a dark, spotted region. This region is modeled using an information limit optimization analysis (Budding and Zeilik, 1987). We have taken $T_1 = 5780$ K, $T_2 = 5260$ K, and $i = 85.29^\circ$



FIGURE 1: Finding Chart for 1E1919+0427 with Comparison Stars labeled.

V-Band Instrumental Magnitudes

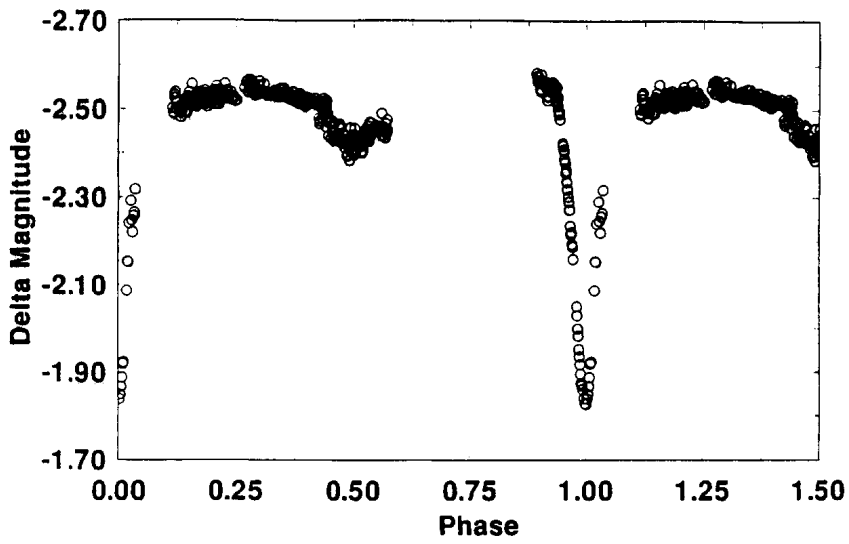


FIGURE 2

V-Band: One Spot Fit

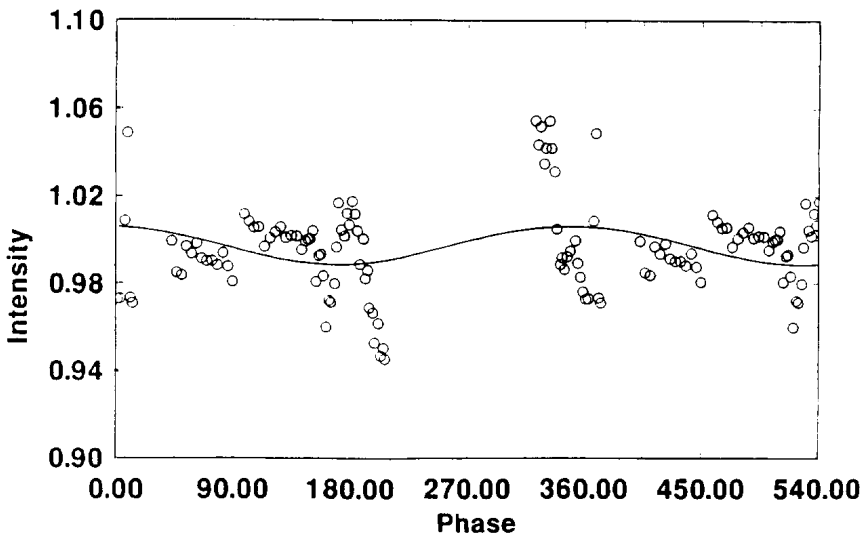


FIGURE 3

to make this fit with a black ($T = 0K$) spotted region. The derived starspot parameters were: longitude = $168.49^\circ \pm 14.32$, latitude = $87.25^\circ \pm 0.42$ and radius = $38.42^\circ \pm 0.31$. Because we only sample the star in V-band we do not have enough information to find a blackbody spot temperature. Clearly, we need complete light curves at two colors in consecutive observing seasons to track the magnetic activity of this system.

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