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SPECTROSCOPY OF THE RS CVN BINARY HR 4430 (EE UMA)

HR 4430 (HD 99967, EE UMa) is a K2III star which is a spectroscopic binary with an orbital period of 74.9 days (Northcott 1947). Boyd, Genet, and Hall (1984) discovered HR 4430 to be a variable star with a small photometric amplitude, and suggested the variability was due to a combination of ellipticity and starspots. More extensive photometry extending over several observing seasons (Strassmeier *et al.* 1989a) has supported this interpretation. HR 4430 is apparently only a weakly active RS CVn-type binary, since Strassmeier *et al.* (1989b) find only weak Ca II H and K reversals, with emission surface fluxes only slightly higher than what is observed on the sun.

The spectroscopic observations reported here were obtained with the Cassegrain echelle spectrograph and intensified Reticon detector at Ritter Observatory (Bopp, Dempsey, and Maniak 1988). Fifteen spectra of the H α region were obtained in 1988, having 0.3 Å resolution, and signal-to-noise ratio of 50-75:1. The H α feature in HR 4430 (Figure 1) is an unremarkable absorption line; the metallic lines show a slight rotational broadening (Strassmeier *et al.* 1989a). The only possible abnormality of the H α line is its slightly high residual intensity (Strassmeier *et al.* 1989b), which could indicate a small filling of the line core by emission. There is little or no evidence for any variability in the line profile or equivalent width.

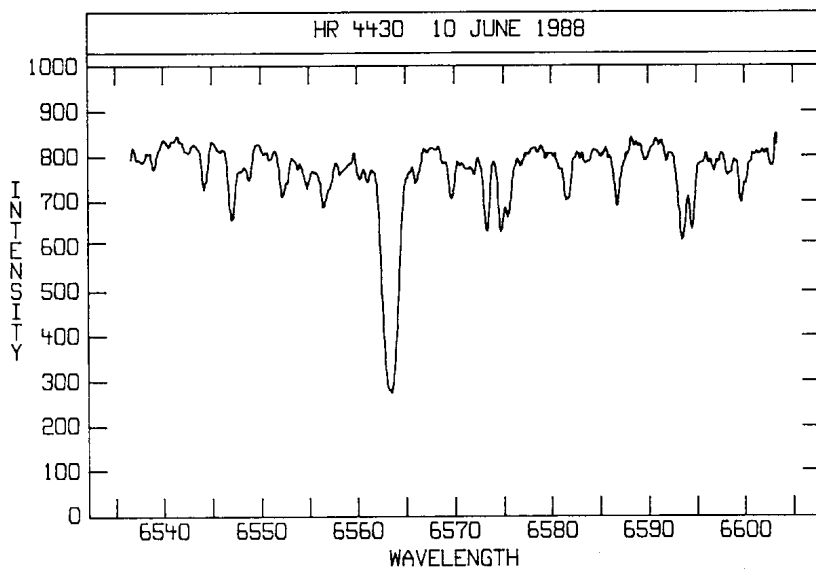


Figure 1: The H α region of the RS CVn binary HR 4430 (EE UMa), from a Ritter Observatory Reticon scan.

Table 1

New Radial Velocity Measures of HR 4430

HJD-2,447,000	V_r (km s $^{-1}$)
299.6159	+20.7
306.6397	+7.9
308.5986	+2.3
313.6402	-1.5
316.5966	-1.6
317.5965	-2.0
319.6405	-1.3
320.6025	+0.9
322.6090	+1.9
323.6353	+3.5
325.6265	+6.5
327.6107	+8.3
329.6273	+15.9
332.6031	+23.2
333.6096	+24.6

Table 2
Orbital Elements of HR 4430

$P = 74.8737 \pm 0.0013$ days
$K = 29.15 \pm 0.30$ km s ⁻¹
$\gamma = +27.58 \pm 0.21$ km s ⁻¹
$e = 0.024 \pm 0.011$
$\omega = 182 \pm 49^\circ$
$T = \text{JD } 2,447,316.4 \pm 10.1$
$a \sin i = 3.00 \pm 0.0016 \times 10^7$ km

The orbital solution for HR 4430 was obtained over forty years ago, and phases using this solution are now subject to uncertainty that complicates photometric modelling. Accordingly, we measured our H α scans of HR 4430 for radial velocity in order to update Northcott's orbit. We employed a cross-correlation procedure that has been described by Bopp and Meredith (1986), using β Gem or α Boo as standards. A listing of our new velocity measures is given as Table 1. A least squares orbital solution was derived using Northcott's published data and the new Reticon values, giving the latter double weight in the solution. The updated orbital elements are given in Table 2. Small improvements have been made in the mean errors of most elements and the period has been improved by a factor of ten.

The orbital eccentricity is small, and probably not significant, so in order to establish a phase for spot modelling, it is useful to establish a time of conjunction T_c , with the cooler

(primary) component in front. For HR 4430, a modern T_c occurs at JD 2,447,334.269.

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