# ULTRAVIOLET OBSERVATIONS OF BETA CANIS MAJORIS AND BETA CEPHEI

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The star Beta Canis Majoris is a second magnitude B1 II with a radial velocity variation of 6-12 km/sec in a $6^h02^m$ period. The star Beta Cephei is a $3\overset{m}{.}3$ B2 III with a radial velocity variation of 18-46 km/sec in a $4^h34^m$ period. Observations of β CMa were taken by OAO-2 on March 12, 1971 with Scanner 2. A typical scan is shown in Figure 1. One can see the H I, Si IV and C IV resonance lines. All parts of the spectrum (lines and continuum) show the $6^h02^m$ variation.

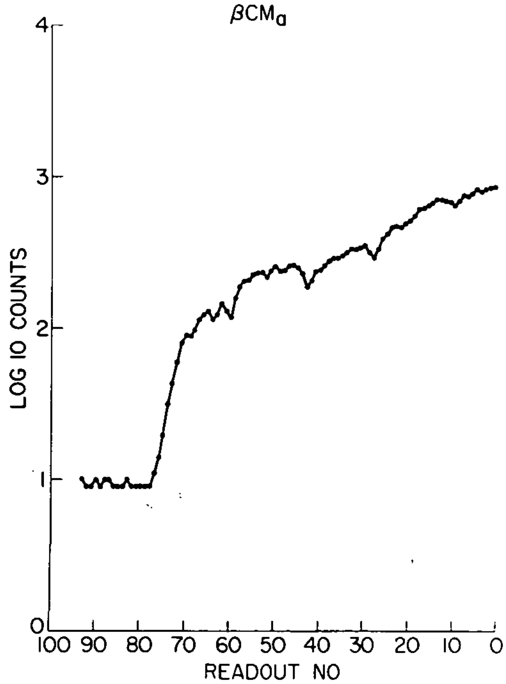


*Figure 1.—$Log_{10}$ of the counts versus grating position of Scanner 2 for β CMa on March 12, 1971.*

Similar observations of β Cep were taken on April 5, 1971 which are shown in Figure 2. The Si IV and C IV lines are both present and strong. Additional scans were obtained on April 19, 1971, one of which is shown in Figure 3. It is very obvious that the C IV line has disappeared. Because of this unusual effect, more data was obtained on the 6, 7, 8, 9, 11, 13, 15, 17, 18, 19 and 20 of June 1971. A total of 64 scans of β Cep, covering 400 cycles of the $4^h34^m$ pulsation over 76 days were obtained.

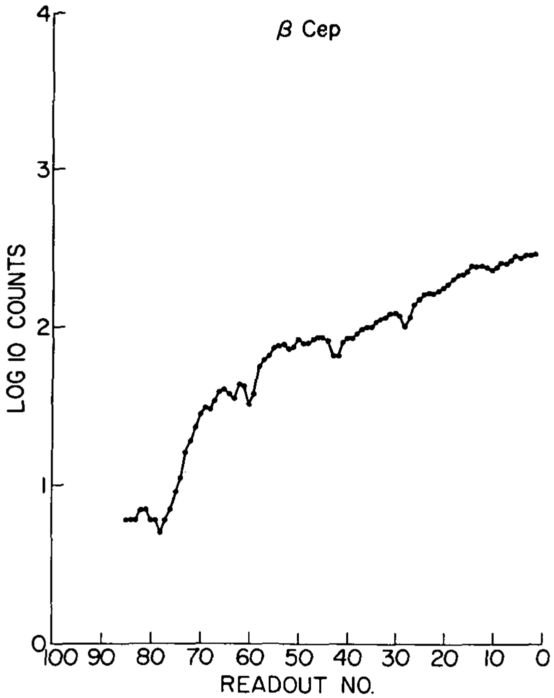


*Figure 2.—Same as Figure 1 for β Cep on April 5, 1971.*

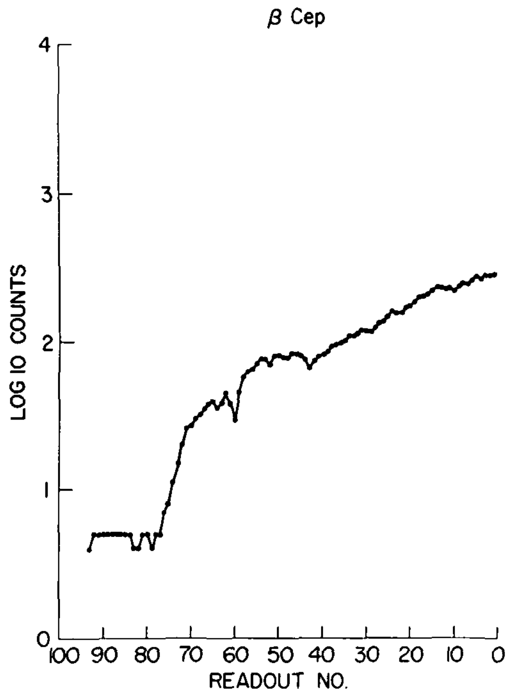


*Figure 3.—Same as Figure 2 on April 19, 1971.*

The bottom of Figure 4 shows the light curve at 1570 Å, the continuum near the C IV line at 1550 Å. The phase is over the $4^h34^m$ pulsation. The upper curve is at 1550 Å, which is approximately the center of the C IV line. The lower points on this curve occur when the line is very strong and the upper when it is weak. The earliest data are shown, for convenience, with special symbols. (Julian Day 47 is April 6, 1971, day 61 is April 19, day 109 is June 6, etc.) Looking at the X's which represent data taken on June 8 and 9, we see the short period variation is the same as the continuum.

Figure 5 shows the "equivalent width" in counts for the C IV line using data at 1540, 1550 and 1500 Å with the continuum being drawn between 1530 and 1570 Å. The variation at 1530 Å is the same as that at 1570 Å. The phase is over a

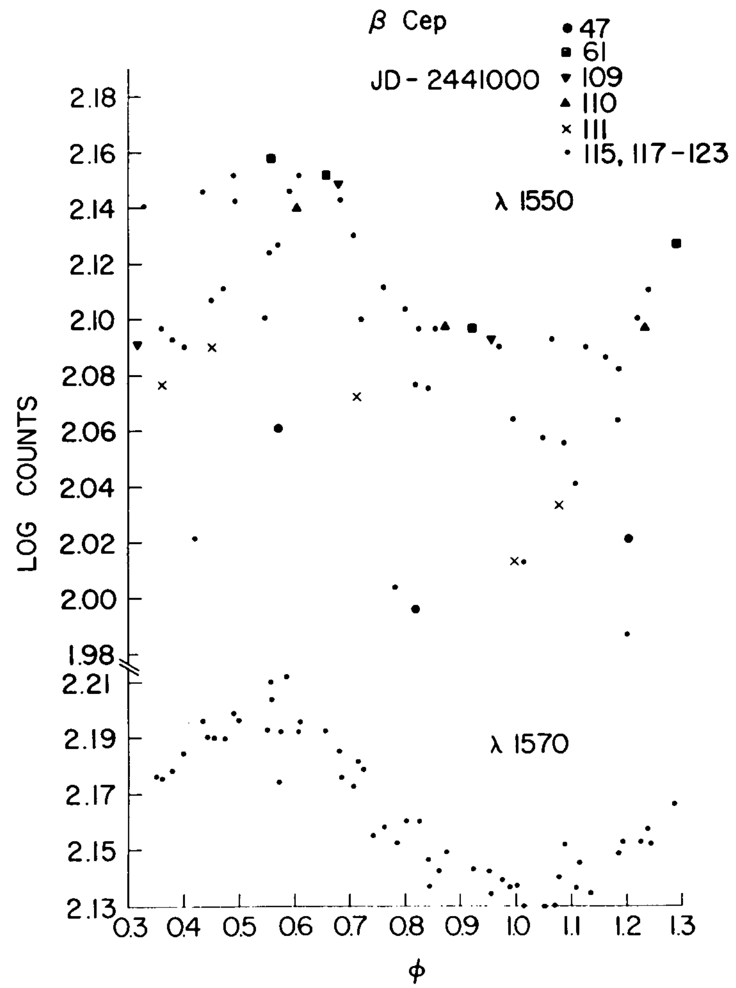


*Figure 4.—Log₁₀ of the counts versus phase of $4^h34^m$ period of β Cep. The lower curve is at 1570 Å, the upper curve at 1550 Å. See text.*

period of 6 days. The estimated uncertainty is less than ± 1/4 day. The $4^h34^m$ variation has not been removed from the equivalent widths because of the difficulty in estimating the amplitude of the short period variation. There is no six day variation in the continuum.

The C IV line is very luminosity sensitive whereas Si IV is not (Sparks and Fischel, 1971 NASA SP-3060 and Code, Utrecht Meeting).

We can only hypothesize three possible mechanisms giving rise to such an effect: a beat phenomenon, shock waves or tidal distortions. If it is a beat phenomenon, the other pulsation has a period of $4^h34^m$ and no such variations are known.

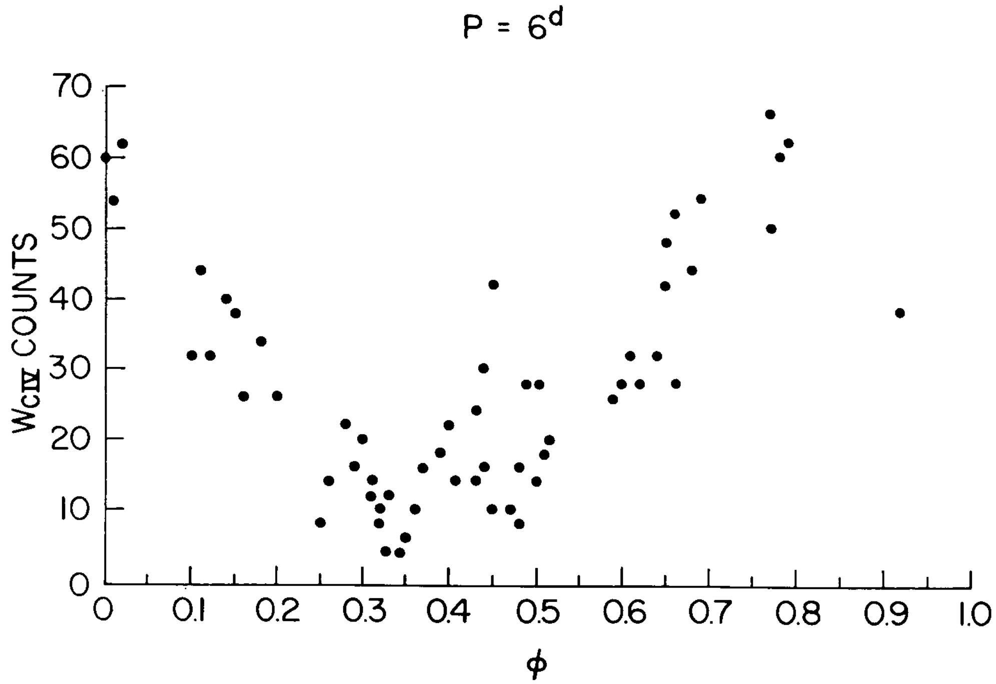


*Figure 5.—The "equivalent width" of the C IV line 1550 Å versus phase over $6^d$ period.*

It is difficult to understand how a shock wave would affect only C IV and not have any thermal effects on the continuum or Si IV.

A tidal effect is possible. Fitch (1969) has presented evidence that β Cep is a single line spectroscopic variable with a period of approximately $10^{d}.9$, and an eccentricity of approximately 0.5. The mass function and a sin i that he obtained are very low. However, the mean radial velocity due to binary motion of about 3 km/sec makes the analysis difficult.

If the effect is due to tidal distortion, the period of revolution could be 12 days if the inclination is sufficiently small to keep one tidal bulge out of sight and large enough to keep the secondary from eclipsing the primary.

In any event, future analyses of β Cephei will have to account for the periodic variation of the C IV resonance line.

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REFERENCES

*Fitch, W. S. 1969, Ap. J. 158, 269.*