THE LIGHT VARIATION OF γ CORONAE BOREALIS*

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The brightness of γ Coronae Borealis varies in both blue and yellow light by about $0^m.05$ in a time scale of about $0^d.03$. The star appears to be a δ Scuti star. It has the earliest spectral type of any known δ Scuti star, and is the only one for which a direct determination of the mass exists.

The bright star γ Coronae Borealis (HR 5849, HD 140436) is noted in the *Catalogue of Bright Stars* (Hoffleit 1964) as a suspected variable star. On the basis of 16 scattered photometric observations, Fernie (1969) has confirmed the variability and has suggested on the basis of the star's spectral type that it might be a δ Scuti star. The present paper confirms this classification and points out a number of interesting properties of this star.

Observations of γ CrB were obtained during July and August 1969 using the 48-cm reflector of the David Dunlap Observatory. The telescope was equipped with a conventional photometer, used in the one-channel mode. The signal from an unrefrigerated EM1 6094 photomultiplier operated at 1300 volts was amplified by a Keithley D.C. amplifier whose output was in turn connected to a Vidar voltage-to-frequency converter. The resulting frequency was measured by means of a digital counter. Observations were made in blue light relative to θ CrB, and in yellow light relative to δ CrB. Observations were made in the following order: γ CrB, comparison star, sky, comparison star, γ CrB. Each observation consisted of five ten-second readings. Differential extinction corrections were made in the normal way. The magnitudes obtained were left on the instrumental system. The mean absolute error of a single observation has been estimated, from observations of the check star ι Serpentis to be $0^m.003$. The results are shown in Figure 1. It is apparent that (a) γ CrB is variable in both yellow and blue light, the amplitude being about $0^m.05$ in each case, and (b) although the variation is not strictly periodic, there is a characteristic time scale of variation of about $0^d.03$. The quasi-periodicity is especially apparent in yellow light on July 22.

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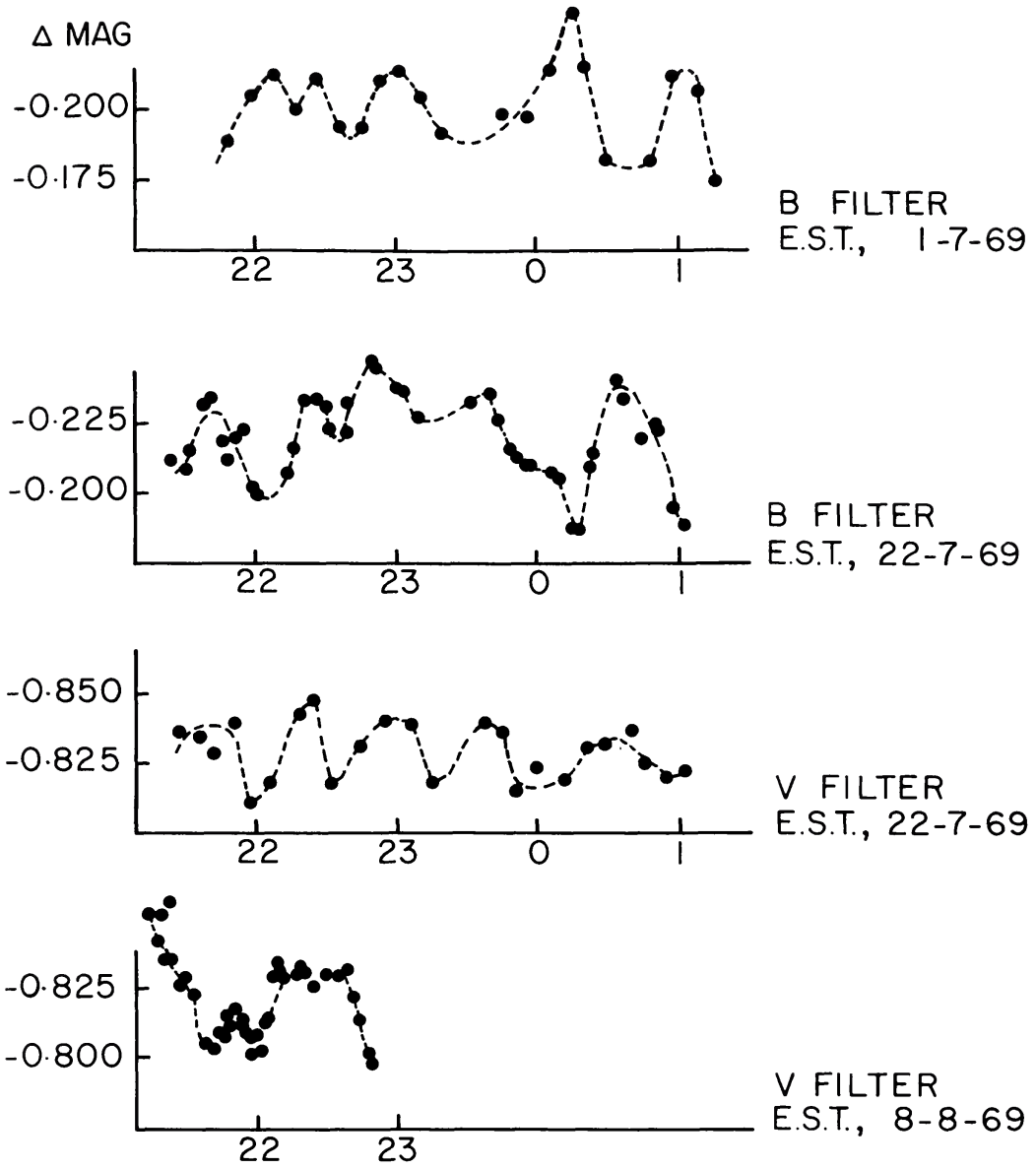

FIG. 1 — Differential photometric observations of γ CrB. The date and filter are indicated in each case; the comparison stars used are noted in the text.

The light variations of γ CrB are similar to those of other δ Scuti stars of early spectral type (Breger 1969; Millis 1968) which also show small light amplitudes, lack of precise periodicity, and short time scales of variation. Whether these variations are due to radial pulsation in a high overtone, to nonradial pulsation, or to some other phenomenon cannot be stated at present.

γ CrB, along with γ Ursae Minoris (Joshi, Gurtu, and Joshi 1969) has the earliest spectral type of any known δ Scuti star. The spectral type is A0 IV according to the *Catalogue of Bright Stars* and A1 Vs according to Cowley, Cowley, Jaschek, and Jaschek (1969). Thus these two stars at present define the high temperature limit of the δ Scuti instability region.

γ CrB is of interest also because it is a visual binary with a known orbit. The orbital elements (P = 91.0 yrs, a = 0".74), the parallax (π = 0".026), and the difference in magnitude between the components ($\Delta m = 3^{m}0$), indicate that $\mathfrak{M}_1 + \mathfrak{M}_2 = 2.8\ \mathfrak{M}_\odot$ and that $\mathfrak{M}_1 = 1.9\ \mathfrak{M}_\odot$. Although neither the orbit nor the parallax is of high precision, the value derived for $\mathfrak{M}_1$ is reasonable for a main-sequence A1 star. An attempt to derive the parallax of γ CrB using another method, such as narrow- or intermediate-band photometry, would be worthwhile.

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A MASS RATIO FOR 112 HERCULIS

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The mass ratio of the spectroscopic binary 112 Herculis is found to be 2.06 ± 0.17. This is in good agreement with the value expected from the spectral types of the two components (B7 V and A3 V). The sharpness of the line spectra suggests that the stars are rotating synchronously with their orbital motion.