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NEW OBSERVATIONS OF GAMMA BOOTIS

PREVIOUS OBSERVATIONS

The star Gamma Bootis (BS 5435, A7 III, m_V = 3.03) was identified as a variable in 1914 (P.Guthnick, R.Prager), and has been studied frequently since that time.

a) Its brightness variations, especially observed during the period 1923-1943 by M.Güssow (1928, 1930), P.Guthnick, H.Fischer (1940), P.Guthnick, H.Schneller (1942), show an irregular behaviour: the variations reach 0.05 magnitude, then become no more detectable, and at last reappear with no regularity (N.L.Magalashvili, J.J.Kumsishvili, 1965).

No correlation has been detected between the radial velocity measurements, and the phase of the luminosity variations (G.R.Miczaika, 1952).

b) Gamma Bootis was observed photometricaly by our group (A.Baglin, F.Praderie, M.N.Perrin) in April 1968 and in 1969 with the 60 cm telescope of the Observatoire de Haute-Provence. Instrumental problems (the photomultiplier nearly underwent a fatigue effect owing to bright illumination) or bad weather conditions did not allow us to obtain good light curves. However, one can think the light variations, if they existed, were less than 0.02 magnitude. A simultaneous high dispersion spectrographic study was carried out with the electronic camera: variations in the shape of the line profile, in equivalent width and half width of the K line were clearly shown. (J.M. Le Contel, F.Praderie, A.Bijaoui, M.Dantel, J.P.Sareyan 1970).

OBSERVING CONDITIONS

We could observe Gamma Boo in the night of 6-7th April 1970 for more than two hours, centered on the meridian transit. The instrument was the 76 cm telescope of the Jungfraujoch Observatory (Switzerland).

a) The filters were those of the Geneva photometric system, (U, B, V, B_1, B_2, V_1, G), (F.Rufener, 1970). The photometer was built at the Geneva Observatory, and modified in order to work on bright stars without any fatigue effect,

and, moreover, to limit the systematic chromatic errors (J.P.Sareyan, 1970). The photomultiplier was a 20 dynodes of the Lallemand type ("Thierry"). The high voltage was 730 volts, its repartition increasing towards the cathode (140, 86 and 80 volts on the first three dynodes). The photomultiplier temperature was kept at +2°C $\pm$1°.

b) We chose Beta Bootis (BS 5602) as a comparison star, in spite of its distance (6°) to Gamma Bootis: the quality of the night (3600 m height above sea-level) justified this choice, the extinction being only about

0.01 magnitude for Δ (sec z) = 0.1 in the U filter, and

0.01 magnitude for Δ (sec z) = 0.3 in the V filter,

during the observations.

RESULTS

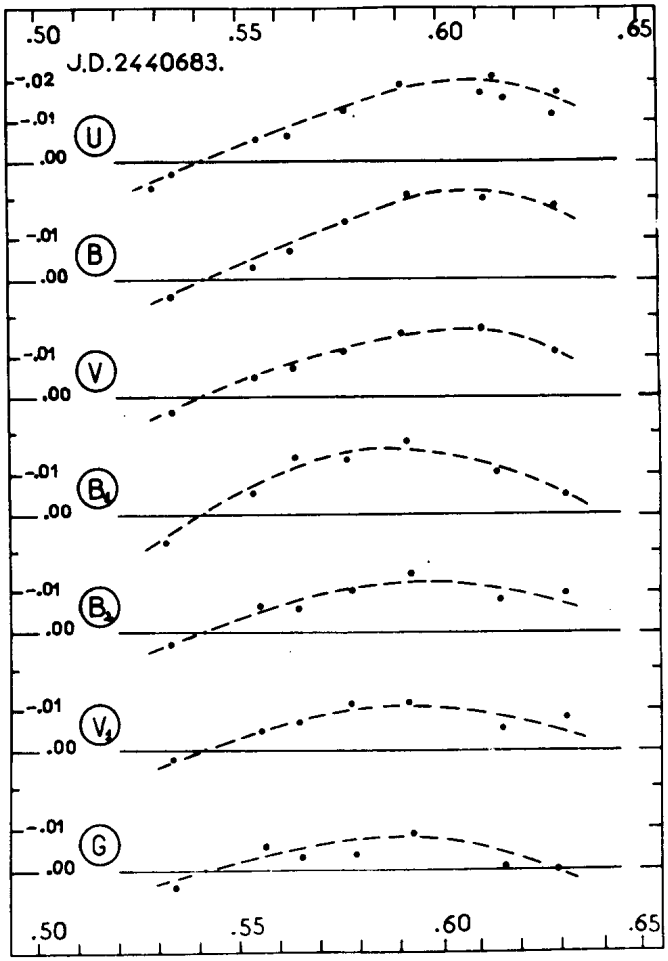
Our observations through the different filters are plotted on the figure. The magnitude difference "Gamma Boo - Beta Boo" increases towards the top of the figure. The difference was chosen equal to 0.00 at 1^h U.T.on 7th April 1970. The spectral sensitivity of the photomultiplier is not yet definitively calibrated in the Geneva Observatory photometric system; so, one cannot consider the origin of the ordinates in the figure as equivalent to the values of the Geneva Observatory catalogue for Gamma Bootis (n°941), in F.Rufener, 1970). However, the shape and amplitude of the light curves would not be greatly affected in the Geneva system itself. The brightness of Gamma Bootis reaches its maximum at J.D. 2440 683.605, i.e. phase .95 $\pm$ .05, if one agrees with N.L.Magalashvili and J.J.Kumsishvili (1965):

$$\text{Max.} = \text{J.D.}2437020^d.440 + 0^d.2903137 \cdot E$$

This agreement in phase, good enough for the only maximum observed, allows us to think that no phase alteration has occured in the star pulsation, as previously observed in 1936-1940 (G.R.Miczaika, 1952).

The observed amplitudes seem to decrease rather regularly with increasing effective wavelengths, from .042 $\pm$ .004 magnitude in the U filter, to .032 $\pm$ .004 in the V filter. I.e., the star is "bluer" at its maximum brightness.

We find a variation $\Delta(V) > \Delta(B-V)$ in agreement with the observations of classical Delta Scuti stars. N.L. Magalashwili, J.J.Kumsishvili (1965) found $\Delta(V) \leq \Delta(B-V)$ in



1962 with their own blue and yellow filters. When the light variation of Gamma Bootis can be detected, the amplitudes vary in a very wide range. According to N.L.Magalashvili, J.J.Kumsishvili, and M.Jerzykiewicz' (1968) observations the amplitude varied approximately between $^{m}.01$ (i.e. about the detection limit) and $^{m}.11$ in B. (We obtained .040 $\pm$ .004).

REMARKS

a) The amplitude variations are perhaps caused by a beat phenomenon. Gamma Bootis has sometimes been classified as a Delta Scuti star, a type in which many stars present the same phenomenon.

We tried to find out the secondary period which could account for the amplitude oscillations (assuming an amplitude $\leq^{m}.01$ when the star presents "no variation"). The secondary period should be about one second longer than the observed one, the "beat period" being probably about 7000 days.

If this result is significant, a large number of further observations should be needed to confirm it. (Especially, an increase in the amplitudes might occur within the next years).

b) From the lack of phase lag in more than 30 years of irregular luminosity variations, one may think, Gamma Bootis is a regular pulsating star, its brightness variations being damped by an episodic photospheric phenomenon accounting for the erratic amplitudes of the observed brightness.

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