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VARIABLE B IN M33: A BINARY STAR?

Variable B is one of the classical Hubble-Sandage variables in M 33 (Hubble and Sandage 1953). Photographic and UBV(R) photometry or light curves were published by Hubble and Sandage (1953), Humphreys (1975), Humphreys et al. (1984), Rosino and Bianchini (1973), Sharov (1973, 1981) and van den Bergh et al. (1975).

Variable B was observed with the 60/90/180 cm Schmidt-telescope of Konkoly Observatory at Piszkesteto between 1965 and 1987, for details see Lovas and Zsoldos (1988). The magnitudes are given in Table I and the light curve is plotted in Figure 1. After the last large maximum at 1963.5 (Rosino and Bianchini 1973) the star probably had two small ones at 1982.0 and at 1986.5 with amplitudes of about 0.6 mag. These small maxima are similar to those at 1927.5 and 1934.9, observed by Hubble and Sandage (1953).

There is a marked difference between the forms of the light curves of the Hubble-Sandage stars in M 33 (see e.g. Figure 6 of Hubble and Sandage (1953)). The light curve of Variable B - though not in contradiction with the standard interpretation of Hubble-Sandage variables (Lamers 1987), - may strengthen the case for the binary hypothesis of some of these stars. Figure 2 shows the amplitudes of the maxima as a function of time elapsed since the last maximum (data from Rosino and Bianchini (1973) and from Figure 1). It indicates that after a larger maximum it takes usually more time to reach the next one. Bath (1977) pointed out that the Hubble-Sandage stars might be similar to cataclysmic binaries though on a larger scale.

Table I

Photographic observations of Variable B

| J.D. 2400000+ | $m_{pg}$ | J.D. 2400000+ | $m_{pg}$ | J.D. 2400000+ | $m_{pg}$ |
|---|---|---|---|---|---|
| 39090.51 | 14.8 | 41714.34 | 16.7 | 44136.58 | 16.6 |
| 39498.38 | 15.3 | 41903.53 | 16.7 | 44167.47 | 16.6 |
| 39529.30 | 16.0 | 41921.55 | 16.8 | 44256.30 | 16.7 |
| 39711.55 | 15.6 | 42008.55 | 16.8 | 44554.47 | 16.5 |
| 39766.41 | 15.8 | 42066.40 | 16.8 | 44912.59 | 16.1 |
| 39796.44 | 16.0 | 42095.30 | 16.8 | 44989.29 | 16.1 |
| 39827.53 | 16.1 | 42278.44 | 16.7 | 45018.31 | 16.2 |
| 40073.56 | 16.0 | 42397.36 | 16.6 | 45197.53 | 16.1 |
| 40092.48 | 15.6 | 42473.31 | 16.7 | 45230.43 | 16.5 |
| 40144.49 | 15.5: | 42695.46 | 16.8 | 45261.46 | 16.7 |
| 40157.49 | 16.3 | 42725.47 | 16.8 | 45347.26 | 16.6 |
| 40183.42 | 16.8 | 42754.44 | 16.8 | 45593.50 | 16.3 |
| 40203.38 | 16.6 | 42756.50 | 16.7 | 45615.46 | 16.3 |
| 40230.24 | 16.7 | 43013.52 | 16.7 | 45647.49 | 16.5 |
| 40654.32 | 16.4 | 43072.49 | 16.7 | 45940.56 | 16.1 |
| 40798.54 | 16.5 | 43191.30 | 16.7 | 46026.43 | 16.2 |
| 40837.56 | 16.8 | 43344.57 | 16.6 | 46030.28 | 16.1 |
| 40916.47 | 16.6 | 43399.43 | 16.7 | 46321.43 | 16.0 |
| 41164.53 | 16.7 | 43430.50 | 16.5 | 46355.55 | 16.0 |
| 41183.50 | 16.7 | 43464.50 | 16.8 | 46441.35 | 15.9 |
| 41213.45 | 16.4 | 43489.29 | 16.6 | 46468.36 | 16.0 |
| 41518.55 | 16.5 | 43720.55 | 16.5 | 46677.57 | 15.9 |
| 41520.51 | 16.5 | 43756.43 | 16.6 | 46706.41 | 15.8 |
| 41625.46 | 16.7 | 43757.56 | 16.7 | 46738.50 | 16.1 |
| 41679.26 | 16.8 | 43787.54 | 16.7 | 46763.46 | 16.3 |
| 41687.38 | 16.8 | 43809.56 | 16.7 | 47060.48 | 16.2 |
| 41689.28 | 16.6 | 43815.28 | 16.6 | | |

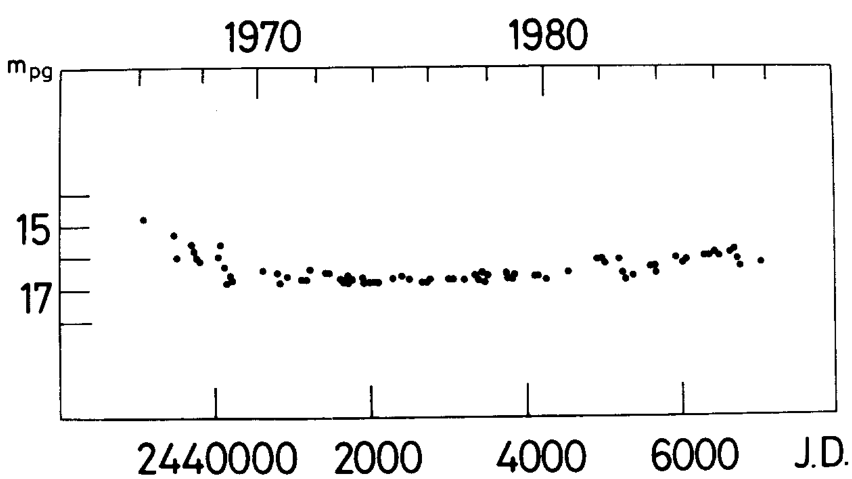


Figure 1

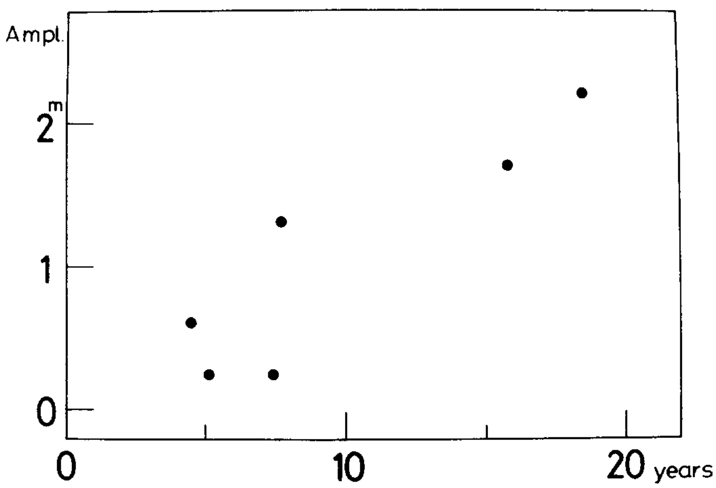


Figure 2

Kenyon and Gallagher (1985) also favoured the binary nature of some of these variables. Assuming that Variable B is really a binary star, Figure 2 then corresponds to the outburst period-energy relation observed in cataclysmic variables (Bath and van Paradijs 1983).

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