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OPTICAL VARIABILITY OF Her X-1
(HZ Her)

The star HZ Her which had been identified with the X-ray source Her X-1 in IAU Circ. 2415 was estimated on 197 Sonneberg plates of 1934 to 1940 and 1959 to 1972. The optical variability as it is shown by our plates (exposure times generally between 0.5 hour and 3 hours) is rather curious:

1.) The "occultation" period given first by Tananbaum et al. (ApJ 174, L 143) for the X-ray intensity cycle can be verified with evidence for the following intervals:

JD 242 7666 to 242 8345 and
JD 243 6607 to 244 1443 (last plate).

The mean light curve assembled by the elements

$$t_{\text{Min.}} = 244 1397.584 + 1.70017.E^d$$

is slightly unsymmetric, thus resembling a δ Cephei curve. Amplitude ≈ 1.5 mag. (pg); "occultation centre" of Tananbaum et al. at phase 0.00.

2.) In the intervals

JD 242 7544 to 242 7657 (begin of our series)
and JD 242 8627 to 242 9789

the star was faint and varied by 0.5 mag. at best. The 1.7-day period is working also in these intervals and a second minimum near phase 0.5 is present in the mean light curve. Note that the short transition time between 1.) and 2.) centred at JD 242 7661 is an upper limit.

3.) The 35.7-day cycle of Tananbaum et al. cannot be found in our material. Especially, between 1972 March 13 and March 20 when the 1.7-day cycle of the X-ray source had to be "silent" according to the authors quoted, the 1.7-day period is verified by 22 good plates, with full amplitude.

Items 1.) and 2.) can simply be explained by physical variability of the X-emitting component of the pair: during

the intervals 2.) the surface brightnesses of the two components were of comparable value whereas in case 1.) the X-star is enhanced. One wonders whether X-rays perhaps are sent out in state 1.) only. - Item 3.) supports the fourth possibility suggested by Tananbaum et al. (l.c., L 149), that is the precession of the X-pulsar beam with the period of 35.7 days. Clearly, this mechanism does neither strongly effect the revolution of the two components nor the other optical properties whereas each of Tananbaum's three further possibilities should have consequences with regard to the optical light curve. Note that the decrease of the amplitude of the 1.7-day cycle in state 2.) obviously has nothing to do with the 35.7-day cycle.

For further details see next number of MVS.

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