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ON THE BRIGHTNESS VARIATIONS OF A STAR IN THE VICINITY OF Cyg X-I WITH THE TIME-SCALE OF TEN MS

At the Crimean Astrophysical Observatory a special TV method is used to detect short-periodic light variations (pulsations) of stellar objects with periods down to 0.001 sec (1). Its principle is as follows. Periodic stepwise variations of electro-magnetic field applied to the image tube, used as a light preamplifier, cause discrete shifts of the image on the TV screen. If the field variation period equals the light variation period of the object the multiple picture of he object on the screen covers all phases of its light variation. In other words,we get a resolution of the light into phase intervals. To detect an object with unknown pulsation period the period of resolution has to be varied constantly.

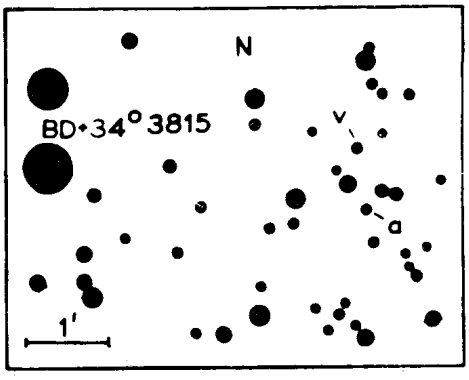

Figure 1

Using such a method a blue star of 17th magnitude situated 3.'3 westward from the X-ray source Cyg X-I labeled by v in Fig.1 was observed in 1971 and 1972 with a 50 cm telescope (F= 6.5 m). The observable field was 1.'5 which enabled to photograph some neighbouring stars together with the mentioned star. The search for pulsations of the star has been carried out with the resolution into eight phase intervals, the resolution periods varying in the limits between 0.0731 and 0.0754 sec. A comparison star labelled by a in Fig.1 chosen inside the field was also observed. Three pairs of histograms for both stars showing frequencies of deviation from the mean brightness were plotted using three random samples each amounting to about hundred brightness measurements of both stars. As can be seen in Figure 2, the brightness scattering of the star under consideration is about twice larger than that of the control star. Besides, the histograms of tha star under consideration are asymmetric and have different shapes on the right and left wings. This might be

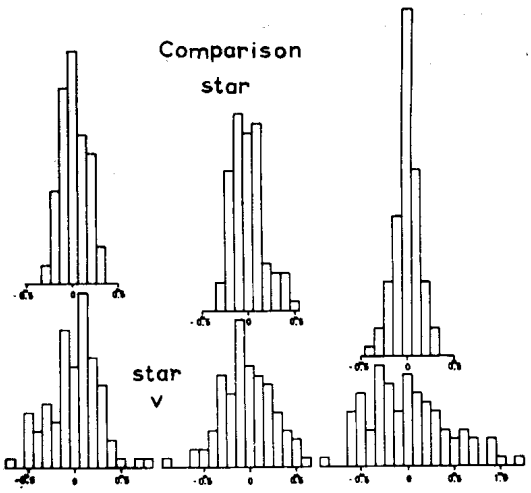

Figure 2

due to short-time brightness variations having a non-periodic or quasi-periodic character. From the observational material obtained on July 30,1971 (30 sec exposures) it was possible to reveal the periodicity of the pulsations of the star with p=0.0745 sec, and according to the observations of August 18, 1972 (60 sec exposure) the period was 0.07395 sec. In both cases the characteristic radiation pulses had a duration about of 10 msec.

The brightness and B-V colour of the star obtained from television pictures taken on October 31, 1972 was $m_v = 17^m.21 \pm 0.10$, B-V = $0^m.57 \pm 0.10$. In the colour-luminosity diagram (Fig. 3) the object is situated in the white dwarf region, if being at a distance of about 100 ps, or near the region of the X-ray source Sco X-I and the pulsar NP 0532,if being at a distance of 1.2-1.5 kps.

The detected peculiarities of the star are similar to those predicted for the black holes accreting interstellar gas (2).

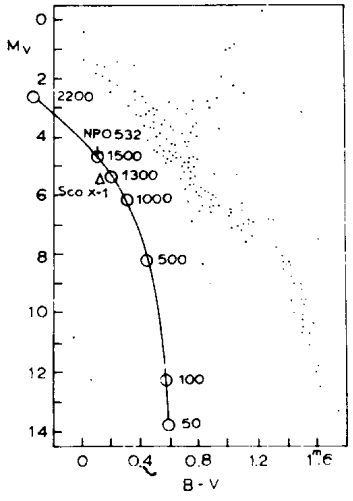

Figure 3

References:
(1) Abramenko A.N., Gollandskij O.F., Prokofjeva V.V., Izvestija of the Crimean astroph.obs.,1972, 49, 89.
(2) Schwartzman V.F.,Astr.Journ.of the USSR, 1971. 48, 479.

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October 8, 1973

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