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Very high energy γ-rays from Cygnus X-3

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Very high energy γ-rays (above 10^{12} eV) from Cyg X-3 have been observed for 7 years at the Crimean Astrophysical Observatory by means of the Cherenkov technique. These observations enable us to find the derivative with time of the 4.8 hour periodicity.

As is well known, the observations of X-rays have revealed time variations of the Cyg X-3 period (see, for instance, Elsner *et al.* 1979). The 'light' curve for very high energy γ-rays has a sharp peak lasting 15 minutes and differs significantly from the 'light' curve for X-rays. For this reason the comparison of the results in these two regions is important.

Using the same method as Manzo *et al.* (1978) we find the value of the derivative with time $\dot{P} = (3.0 \pm 1.4) \times 10^{-9}$ and for the Julian date 2441550.542 the value of the period P_0 is equal to 0.199680 day.

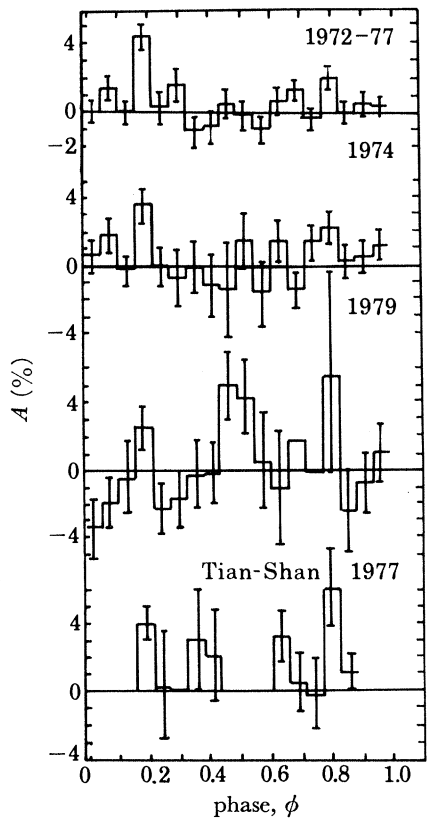

Figure 1. The 'light' curves of very high energy γ-rays from Cyg X-3. A: the γ-ray flux expressed as a percentage of the cosmic-ray background; ϕ: the phase expressed as part of a circle.

Calculating the value of the period P for each year from the expression $P(t) = P_0 + \dot{P}(t - t_0)$ we have found the 'light' curve of very high energy γ-rays for different time intervals. The data obtained at Tian-Shan were also used. These data are presented in figure 1.

As is seen in figure 1 the sharp peak at phase *ca.* 0.2 is present in all curves (the zero phase corresponds to the X-ray minimum). It is also obvious, however, that in 1977 the second peak in the Tian-Shan data was higher. In 1979, the first peak became lower than the peak at phase 0.6. Thus it is clear that the light curve of very high energy γ-rays changes. New observations of this interesting phenomenon are needed.

References (Neshpor *et al.*)

Elsner, R. T., Ghoch, J. P., Darbro, J. W., Weisskopf, U. C., Sutherland, P. G. & Grindlay, J. E. 1979 *Bull. Am. astronaut. Soc.* **11**, 797.

Manzo, G., Molteni, D. & Robba, V. R. 1978 *Astron. Astrophys.* **70**, 317.

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