A MODEL FOR THE DOUBLE SYSTEM CONTAINING THE X-RAY PULSAR HER X-1

G. S. BISNOVATYI-KOGAN and B. V. KOMBERG
Institute for Space Research, Academy of Sciences, Moscow, U.S.S.R.

Abstract. A model for the double system with the X-ray source Her X-1 is considered. It is supposed that the central star has a sufficiently strong magnetic field for the outflow of the matter to occur in jets. When the neutron star is in the jet the optical depth τ_x attributable to the X-ray emission due to Compton scattering is greater than unity and the solid angle of the emitted X-radiation is broad, $\sim 180°$. In the opposite case, $\tau_x < 1$, there is a narrow angle of emission and the radiation falls on to the star and is not observed on the Earth. The motion of the neutron star relative to the jet is due to nonsynchronization between the orbital motion and rotation of the central star. If the duration of the whole orbit around the central star is 35 days and the dimension of the jet is about 1/3 of the orbit, then such a model explains features connected with the 35-day cycle.

The change of the 35-day period is connected with the motion of the magnetic poles of the central star. We predict that the long duration or constancy of the 35-day period must be followed by a long absence of X-ray emission.

The optical features of the emission of the double system are connected with the properties of the emission angle of the synchrotron radiation from anisotropically distributed electrons. When $\tau_x > 1$, the anisotropy is small and the main radiation is in the region $\hbar\omega > 8$ kV, so that after many refractions of the X-rays by the central star and disc, the broad maximum in the optical radiation is formed. When $\tau_x < 1$ the anisotropy is greater, the radiation in the spectral range $\hbar\omega < 8$ kV increases and, because of total absorption of this radiation by the central star, there appears an additional input to the optical radiation which has a sharp maximum, as in the classical refraction effect.

Some observational tests for this model are proposed. For the details see *Astron. J. USSR*, **52** (1975), No. 2.

Sherwood and Plaut (eds.), Variable Stars and Stellar Evolution, 497.