THE X-RAY RADIATION MECHANISM OF THE COMPACT (NEUTRON) BINARY STARS

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Usually we think a X-ray source may be a compact(neutron) binary star on which the X-ray radiation might be generated by gravitational acceleration for the particles coming from the primary and going along magnetic field lines of the compact star to the poles. But, in the past, people don't consider well the problem of particle acceleration. It seems to be simplified for the situation only to consider the gravitation effect, because some electric-magnetic effect in a strong magnetic field could not be neglected. However, it is unreasonable to neglect the plasma turbulent waves in an electric-magnetic field, because strong enough turbulent waves such as Alfven waves, whistlers generated nearby the surface of neutron stars probably contribute energy to accelerate particles, which may be more important than gravitation sometimes. For a binary system with a neutron star if ion number density $N > 10^{17}$ /cm^3 in its surface atmosphere, the turbulent wavess will be stimulated that will accelerate the particles reaching a speed over 10^8cm/s. they strike the atmosphere of the compact star in the system, so that a shock wave is formed which turns part of kinetic energy to heat to form hot spots of about 10^8 K to emit X-ray.

We place the origin of the coordinates at the centre ot the compact star, then we have following equation, 1. The conservation equation of the wave action density. 2. The state equation. 3. The conservative equation for the momentum. 4. The continuity eqution. 5. The conservation equation of magnetic flux.

Using a computer to solve above 5 equations, we can get the particle velocities of this kind of binaries and their temperatures of hot spots calculated by $T = \alpha m V^2/K_B$, where α indicates the energy transfer efficiency when particles going through the shock wave. The result is as follows:

Table 1: Temperature of hot spots ($\alpha = 0.1$)

Item	r(cm)	v(km/s)	T(K)
Neutron star	10^8	15000	1.36×10^9

D. J. Helfand and J.-H. Huang (eds.), The Origin and Evolution of Neutron Stars, 249.