AN INVERSE COMPTON SCATTERING MODEL FOR THE SPECTRA OF X-RAY PULSARS

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Many observations have been reported in the field of X-ray pulsars, but the mechanism for X-ray emission is not well understood. The X-ray spectra can not be simply described in terms of blackbody or thermal bremsstralung. The high-energy cutoff could be due to cyclotron absorption in high ($\geqslant 10^{12}$ Gauss) magnetic fields. For the lower energy it can be fitted by a power law with energy index α.

We present a model of inverse Compton scattering in strong magnetic fields, which might have certain application to the X-ray continuum spectra of X-ray pulsars at energies below that of the first cyclotron harmonic. This mechanism is used to get a good fit for X-ray spectrum of Her X-1. The beaming effect of inverse Compton Scattering in strong magnetic fields can give a beaming mechanism naturally for X-ray emission of X-ray pulsars.

When the electrons and ions infall into polar cap region a space-charge limited flow must develop, as discussed for radio pulsars. We perform calculations using the method discussed by Sutherland (1979). It is shown that this is a very efficient mechanism for acceleration of particles and that the acceleration region is not thick. Using the formulae of Thomson and Compton scattering in strong magnetic fields given by Herold (1979), via Lorentz transformation, the spectra of inverse Compton scattering in strong magnetic fields of an electron have been obtained, then we consider the collective effect to fit the observational data. The theoretical line fits the lower energy spectra of Her X-1 quite well.

References

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