INVERSE COMPTON SCATTERING IN STRONG MAGNETIC FIELDS: APPLIED TO THE RADIATION MECHANISM OF PSR 0531+21

H. Chen, X.J. Wu, G.J. Qiao
Division of Astrophysics, Geophysics Department
Peking University
Peking, China

In strong magnetic field near pulsar's surface, the quantum effect for electrons is quite complicated. The classical approximation may lose resonance feature, which gives much smaller cross-section.

In this paper, we performed numerical integrations to get the total cross-section and the power spectrum of single electron. Thus considering the resonance, the inverse Compton scattering could be an efficient mechanism in strong magnetic fields. We have carefully calculated the power spectrum of single electron travelling through the isotropic thermal fields.

Taking the electron energy distribution $N(\gamma)$ as power law, the same method was used to calculate various non-thermal radaition based on the assumption by Herold that the initial and final states of electrons are in the lowest Lanlau level, which is a good approximation for low temperature ($< 10^6$ K). The index of power law spectrum is given by fitting the calculated results to the spectrum of PSR 0531+21. The spark discharge electron number shows us that for hard X-ray (5 - 500 kev), the radiating energy comes from the Compton radiation mechanism with the electron Lorentz factor of 3 - 50, which is quite reasonable and much smaller than that by other models. Some observations indicate that this mechanism may be important in some radaition bands, even in radio band.

Other interesting features are as follows:

a) From 5 to 500 kev, the electron energy strongly affects the radiation power. The higher the electron energy, the more the radiation emitted.

b) Scattered photon directions are quite close to the incoming electron velocity directions, this is so called Doppler beaming effect. From this, pulsars' narrow pulse width could be explained.

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