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Correlated hard X-ray and gamma-ray radiations from the ions accelerated in cloud regions

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Abstract. Many discussions about probable acceleration mechanisms in the associations OB-stars/ interstellar molecular clouds were stimulated by published COMPTEL observational result on gamma-ray lines with energy 3–7 MeV from Orion region. (Bloemen et.al., 1994; 1997). Later COMPTEL group has disavowed this experimental result. Nevertheless, taking into account the theoretical arguments pro existence of subrelativistic particles in the cloud regions, we can believe that the mission with higher sensitivity like the INTEGRAL can find the gamma-lines produced by locally accelerated particles. The nuclear gamma-lines are effectively produced by ions with energies from a few MeV/n to ~ 50 MeV/n.

In fact the upper limit on the density of accelerated ions in clouds can be settled on the basis of the hard X-ray observation. The X-ray would be produced by accelerated nuclei due to their bremssrahlung interactions with ambient electrons. The maximum bremsstrahlung photon energy is m/M times less then the ion energy, where m and M are the electron and ion mass respectively. For nonrelativistic ions ($T \ll M_p c^2$) and X-ray photons ($E_x \lll m_e c^2$) the cross-section depends only on relative velocity of interacting particle and cross-section of photon production is the same both for electron-nucleus interaction and for the ion-electron interaction.

The result of calculations of the hard X-ray intensity and energy spectrum from the cloud matter as a function of the ion energy spectrum and elemental abundances are presented. In the talk the upper limits of the gamma-radiation from some clouds will be given on the basis of hard X-ray observation by former and present missions as, for example, ASCA.

These upper limits will be useful for the optimization of the observation program of the INTEGRAL mission.

References

Bloemen H. et. al., 1994 A&A, 281, L5 Bloemen H. et. al., 1997, ApJ, 475, L25

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