Analysis of Prognoz - 9 Solar Flare Hard X-ray Data-support for the Non-thermal thick target Model

R.R.Rausaria, Ranjana Bakaya & P.N.Khosa
Department of Physics, Regional Engineering College, Hazratbal, SRINAGAR - 190 006

Solar flare hard X-ray data obtained by Prognoz-9 spacecraft (Abrosimov et al 1988) in the energy range 10-200 keV are analysed. In examples of events which we consider here, high energy X-ray pulses appear earlier than low energy ones, which is contrary to many other events where the low energy X-ray peak emission takes place earlier. The variation of the spectral index was dynamical.

The evolution of energy and angular distributions of electrons at different depths in the solar atmosphere have been studied by combining analytically treated small-angle scattering of electrons with a large angle monte carlo treatment (Haug et al 1985) for initially non-thermal and thermal distributions. Using these distributions and a Sauter bremsstrahlung cross-section, we have computed the energy spectra of X-rays for different column densities and photon energies. The change in the spectral indices of the generated X-rays are graphed in Figure (1) at different column densities (10^{21} - 10^{22} cm^{-2}) for a non-thermal electron distribution. For the case of a thermal model the change in spectral indices is plotted in Figure (2) for different temperatures Nocera, et al 1985. In this case the change in the spectral indices are not as dynamical as in the case of non-thermal model. The spectra are softer for all the temperatures considered. Various curves of Figure (2) can be taken as representative of the variation of the photon spectral index at different depths in the solar atmosphere. For an electron source temperature less than 50 keV, the variation in the photon spectral index will be somewhat greater. However, for high energy photon emission (100-200 keV) such temperatures indicated on the curves will not be possible, which is contrary to observations. Therefore, it may be concluded that non-thermal processes play an important role in hard X-ray characteristics.

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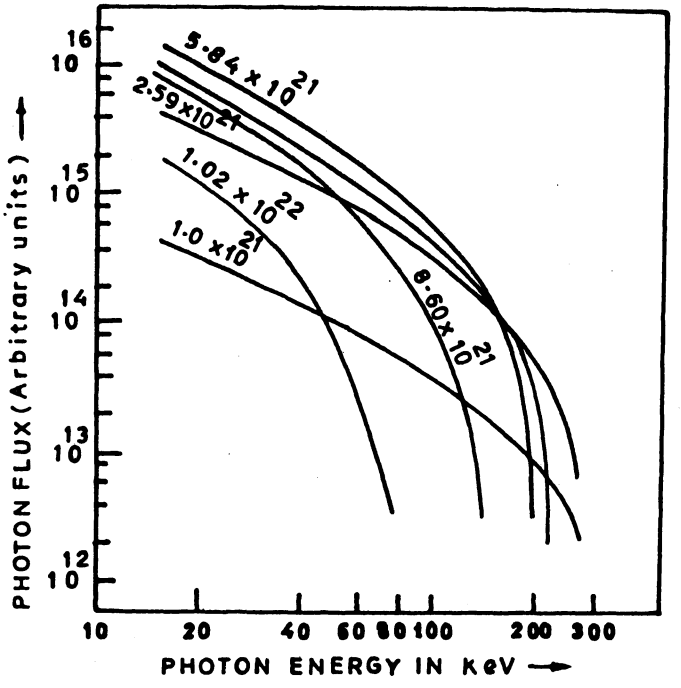

Fig.1. Variation of X-ray flux at different column densities with photon energy for incident electron energy 300 keV and consequent changes in spectral indices.

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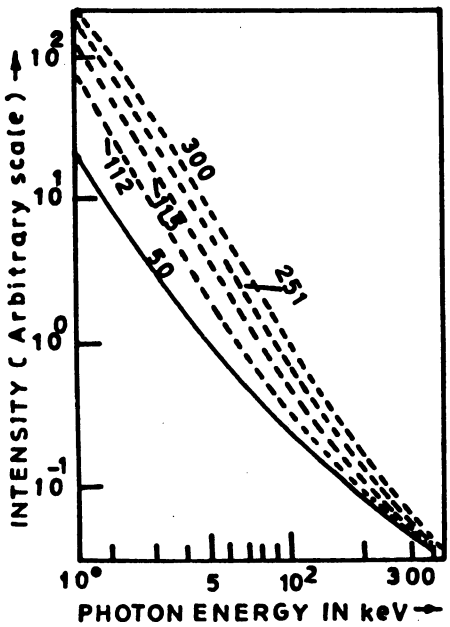

Fig.2. Variation of X-ray intensity and spectral indices for initially thermal electron distribution.

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