ON SPECIAL FEATURES OF NON-THERMAL SOLAR X RADIATION ABOVE 10 keV

G. ELWERT and E. HAUG
Lehrstuhl für Theoretische Astrophysik, Tübingen, Germany

The polarization and angular distribution of solar hard X radiation above 10 keV was calculated under the assumption that the X rays originate as bremsstrahlung from energetic electrons moving in a preferred direction. The source electrons are supposed to have a power-law spectrum. These conditions are to be expected in the impulsive phase of an X-ray burst. The spiral orbits of the electrons around the magnetic field lines are taken into account.

The Figure 1 shows polarization curves as a function of the angle ϑ between the magnetic field and the line of sight for the photon energies 10 and 50 keV and various

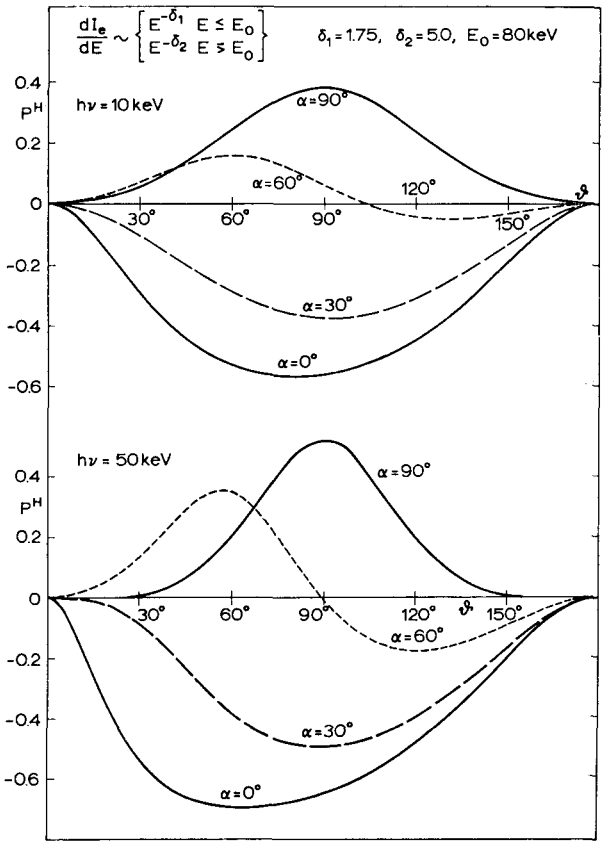

Fig. 1. X-ray polarization as a function of the angle ϑ between the magnetic field and the line of sight for the photon energies 10 and 50 keV and various pitch angles α.

Space Science Reviews **13** (1972) 761–762.

pitch angles α. At angles α near $0°$ and $90°$ the radiation has a considerable degree of polarization. Unlike soft X radiation where the polarization has its extreme at $\vartheta = 90°$ the curves are now asymmetric. Assuming that the X radiation is generated by electrons with a pitch-angle distribution, the degree of polarization is greatly reduced compared to the case of discrete pitch angles.

Another consequence of directed electron beams is the anisotropic angular distribution of X radiation. For low values of α the radiation is emitted predominantly at small angles ϑ. The anisotropy decreases, however, for increasing α, and the angular distribution becomes largely isotropic in the case of $\alpha = 90°$.

In principle the angular distribution of solar X radiation may be measured by means of several satellites orbiting around the Sun. Such an observation would provide information on the pitch angles of the source electrons. A consequence of the anisotropy which might be verified at present is the directivity of solar hard X-ray bursts. Up to now it is difficult to draw any conclusions from the measurements because the statistics of the presently available data are still poor. It is highly desirable to make further observations of the position of X-ray bursts.

Reference

Tindo, P. J., Ivanov, V. D., Mandel' stam, S. L., and Shuryghin, A. J.: 1970, *Solar Phys.* **14**, 204.

DISCUSSION

S. R. Kane: In your calculation have you taken into account the possible scattering of electrons? This effect may be important for ~ 50 keV electrons!

E. Haug: The scattering of electrons was not taken into account. This scattering would alter the pitch-angle distribution of the electrons.

C. de Jager: To which phase in the lifetime of flares is the observed polarisation related?

E. Haug: The polarisation observed at about 1 Å by Tindo *et al.* was a maximum in the initial phase of the flares and it decayed in some tens of seconds. During a second peak of X-ray flux the radiation was polarised again.