Observations of Energetic Electrons in Solar Flares

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A study of the simultaneous observations of solar flares in optical, radio and X-ray bands is important in understanding the process of energy release and particle acceleration in the explosive phenomena of solar flares. In order to determine the characteristics of such energetic electrons in solar flares, a total number of 50 two-ribbon flares have been carefully selected during the period 1979-89 having simultaneous observational data in the optical, X-ray and radio bands.

About 60 % of these solar flares have been found to be associated with high energy proton events of $\geqslant$10MeV. From the analyses of their optical Hα, X-ray and microwave radio data it has been found that:

a) two-ribbon flares are the most powerful sources of particle acceleration.

b) maximum particle acceleration occurs in the early impulsive phase of solar flares.

c) high-resolution Hα, radio and X-ray recordings of a few flares showed good correspondence in their time profiles within one second.

d) radio frequency spectra of the microwave bursts are characterised by a U shape and increases in intensity in the transition from 3 GHz to higher frequencies.

e) the hard X-ray spectra are power law spectra with cut off energies $<$10 KeV with γ= 4-5.

From these observations it is concluded that the two-ribbon flare process is more favourable characteristic for particle acceleration in most high energy events. The most rapid acceleration occurs during the initial impulsive phase of the flare with continued acceleration and injection by flaring-loops originating due to magnetic reconnections occurring throughout the life of a solar flare.

E. R. Priest and V. Krishan (eds.), Basic Plasma Processes on the Sun, 438.