§7. Blue Shift Component and Ion Abundances in Solar Flare Plasmas

Kato, T.
Fujiwara, T. (Dept. Education, Aichi Univ. Education)
BCS Group (Institute of Space and Aeronautical Science)

We have studied time evolution of BCS spectra of He-like S XV, Ca XIX and Fe XXV ions observed by the Yohkoh satellite for two flares on 6th September 1992 at 05:05 and 08:59. Electron temperatures are derived through the fit of the synthetic spectra to the observed ones. Apparent ion temperatures are derived from the line width of S XV and Ca XIX spectra. The time variation of these parameters are compared with HXT, SXT and radio measurements. The ion density ratios derived from the ratios of line intensities of Fe ions show a time-dependent non equilibrium ionization. They are shifted from the equilibrium values indicating ionizing plasma.

In the initial phase before the rising phase, the thermal emission from Ca and Fe spectra of around 1 keV are detected. In the rising phase very broad spectral shape of Ca resonance line is observed. We separated the blue shift component from the main component in the rising phase and derived the ion temperature and the emission measure as shown in Fig.1. The relative velocity of the blue shift component to the main component decrease towards the maximum phase. This decrease coincides with the decrease of the polarization degree of radio.

HXR and radio produced by high energy electrons increase very rapidly in the rising phase similar to the blue shifted component. SXT and BCS flux(Ca, S) increase slower than HXR however BCS flux(Fe) increase rapidly like HXT. It seems that high temperature plasma is created by high energy electrons and the lower temperature plasmas is created later by thermalisation.

Emission measures (EM) are derived without assuming the ionization equilibrium with the use of the line intensity of the resonance line and the continuum for the first time. The values of EM(Fe) and EM(Ca) show almost the same values within 30% during all the phases. EM(S) is generally larger than EM(Ca) and EM(Fe), since EM(S) includes the lower temperature regions than 1 keV.

The density ratios n(Ca XIX)/n(H), n(S XV)/n(H) and n(Fe XXV)/n(H) show the time dependent history; the values in the rising phase are smaller than those in the decay phase as shown in Fig.2. This indicates the non equilibrium ionization of He-like ions. The ion density ratios of Fe ions, n(Fe XXIV)/n(Fe XXV), n(Fe XXIII)/n(Fe XXV) and n(Fe XXII)/n(Fe XXV) are also shifted from the values in ionization equilibrium indicating ionizing plasmas.

![Image of Ca XIX Spectra]

**Fig.1** The observed Ca XIX spectra and the theoretical ones.

![Image of n(He-like ion)/n(H atom) as a function of Te]

**Fig.2** n(He-like ion)/n(H atom) as a function of Te. The dashed lines are the values in ionization equilibrium.