Diagnostics of the Kappa-Distribution from EVE Flare Spectra

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The high energy electrons accelerated by magnetic reconnection in solar flares strongly affect X-ray flare emission, but can also strongly influence the flare EUV emission. RHESSI observations and recent theoretical papers showed that the electron distribution function in coronal X-ray sources can be a kappa-distribution. The synthetic SDO/EVE spectra of kappa-distributions for different values of kappa, temperatures, and electron densities were calculated using KAPPA package based on the CHIANTI. Spectral lines of Fe XVIII - Fe XXIV observed in an X-class flare on 7 March 2012 were investigated for diagnostics of the kappa-distributions and the other plasma parameters. The shape of the electron distribution strongly affects diagnosed electron temperatures, while the electron densities are influenced only weakly. Observed line intensity ratios sensitive to the kappa-distribution correspond to strongly non-thermal kappa-distribution with kappa≈2. This low value of kappa is signature of presence of a strong high energy tail in the electron distribution of emitting flare plasma.