Highlights of Astronomy, Volume 14
IAU XXVI General Assembly, 14-25 August 2006
Karel A. van der Hucht, ed.

doi:10.1017/S174392130700991X

Radio and X-ray diagnostics of electrons accelerated in solar flares

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Abstract. Starting from 2.5D MHD modelling of solar flares on a global scale we calculate (using the PIC and test-particle simulations) the radio and X-ray emissions generated in solar flare reconnection. Our results – the radio and X-ray spectra and brightness distributions, and their dynamics – are directly comparable with observations providing thus a test of particle acceleration models as well as of the 'standard' global flare scenario.

Keywords. Solar flares, acceleration of particles, radio and X-ray emissions

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It is a well known fact that solar flares are efficient particle accelerators – even several concurrent acceleration processes can take place in a single flaring volume. Using MHD and particle simulations we study some of them – namely direct acceleration in a current sheet torn during magnetic reconnection and pinch-effects acting on electrons trapped in non-equilibrium plasmoids newly created by the reconnection process (see also Kliem *et al.* 2000), and acceleration in collapsing magnetic traps (Karlický & Bárta 2006; Karlický & Kosugi 2004) formed by shrinking reconnected magnetic field lines inside cusp structures.

In order to relate our models more directly to the real world, we not only calculate the dynamics of electron distribution functions, but we extend our results to forms comparable with observations. As accelerated particles in the solar atmosphere manifest themselves most remarkably by the radio and X-ray emissions, the final outputs of our modelling are radio and X-ray spectra and their dynamics as well as spatial structures of X-ray and radio sources. The approach used provides not only a test of particle acceleration mechanisms, but also checks the validity of the global flare model in the framework of which the acceleration processes have been studied. Comparing simulated X-ray and radio data with observations, we found that Drifting Pulsating Structures (DPS, see also Karlický *et al.* 2005) can be interpreted as the radio emission of accelerated electrons trapped in ejected plasmoids, and electrons accelerated in the collapsing magnetic trap can account for the brightness distributions and spectra of X-ray flare loop-top sources.

The results obtained are sensitive to the parameters of the flare model used. Thus, fitting the observed and the modelled data provides us with a diagnostic tool for investigation of conditions under which the acceleration in the solar flares proceeds.

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