

Research on particle acceleration in solar flares within the framework of the GEMSIS project

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GEMSIS (Geospace Environment Modeling System for Integrated Studies) is one of the projects in Solar-Terrestrial Environment Laboratory, Nagoya University. Its final goal is to build a geospace-environment model based on various (satellite and ground-based) observational facts in order to understand the dynamic energy-transport-processes taking place in geospace. In the first 3-years from 2007, we set several individual scientific targets as fundamental elements/information for the final model. One of them is to know how particles are accelerated and lose their energies in solar flares. Here, we briefly introduce our approach to this scientific target.

Thanks to Yohkoh and RHESSI observations, some essentials (energy spectrum of accelerated electrons, acceleration site, time-scale of acceleration) for revealing the acceleration mechanism have been somehow obtained. However, we don't have any direct observations about pitch-angle distribution of accelerated electrons even though it is important information to identify the acceleration mechanism.

In some flares, a large amount of accelerated electrons are trapped in the magnetic loop system until they precipitate into the footpoint region due to pitch-angle scattering via collision. At that time, hard X-ray thin-target emission and microwave gyrosynchrotron emissions from trapped electrons are observed in the corona and mainly hard X-ray thick target emissions are observed at the footpoint region. The temporal behavior of spectrum and intensity of each source depends on the initial pitch-angle distribution of accelerated electrons. However, it also depends on other two parameters, i.e., the magnetic mirror efficiency and the plasma density in the loop. First we must determine these two parameters from observations (photospheric magnetic field data and soft X-ray flux). Then, based on them, we must derive constraints on the pitch-angle distribution of the injected (accelerated) electrons by comparing the results derived from the computer calculation like the Fokker-Planck equation with the hard X-ray/microwave observations. In this paper, we explain our approach in the framework of the GEMSIS project.