Energy Budget in Cold Solar Flares Observed with Nobeyama Radioheliograph

*増田 智[1]
*Satoshi Masuda[1]

1. 名古屋大学宇宙地球環境研究所
1. Institute for Space-Earth Environmental Research, Nagoya University

The energy source of solar flare is magnetic energy in the solar corona. When a solar flare takes place, this energy is impulsively released, and it is converted to other kinds of energy such as thermal energy (plasma heating), kinetic energy (mass ejection), and energy of high-energy particles (particle acceleration). The ratio of these three energies seems different in each solar flare. Some solar flares show thermal energy is dominant and the others do non-thermal energy of accelerated particles is dominant. What controls the energy conversion ratio? This is so-called energy budget problem in solar flares.
A hint to solve this problem could be provided by some extreme flares such as thermal-rich flares and purely nonthermal flares. In this study, we focused on so-called cold flare which shows significant nonthermal emissions with relatively very small amount of thermal emissions. We have already analyzed a cold solar flare occurring on 10 March 2011. This flare was well observed with Nobeyama Radioheliograph (NoRH). It shows a significant microwave enhancement (about 210 SFU at 17GHz). This microwave enhancement is produced via gyro-synchrotron emissions by high-energy electrons. However, any significant enhance was not found in the GOES X-ray light curve during the flare period. RHESSI did not observe this flare, but Suzaku detected hard X-rays in the energy range above 100 keV. So it was confirmed that electrons were actually accelerated while plasma heating process did not work well in this flare. The characteristics of this flare were short duration and very compact size. From these facts, we concluded that the magnetic field of the loop top region might be very intense. This might be a key how a cold flare is produced. To confirm this, we need more analyses of similar events. From the event list of NoRH, we pick up candidates of cold flares which show a significant microwave enhancement without any counterpart in soft X-rays and analyze them. The characteristics seem to be the same as the previous event. Then we discuss why thermal emissions (plasma heating) are suppressed in these flares.

キーワード：太陽フレア、電波、粒子加速
Keywords: Solar flare, radio, particle acceleration

