

Study of electron acceleration/propagation processes in a solar flare using Nobeyama Radioheliograph

*Keitaro Matsumoto¹, Satoshi Masuda¹, Takafumi Kaneko¹

1. Institute for Space-Earth Environmental Research, Nagoya University

Particle acceleration takes place during a solar flare. Information about pitch angle distribution of accelerated particles is important to understand particle acceleration/propagation process. Yokoyama et al. (2002) estimated the pitch angle of nonthermal electrons from the propagation speed of a microwave emitting region along a loop using Nobeyama Radioheliograph (NoRH). After that, there is no significant progress in observational studies. Thus, we investigated all the flares between 2000 and 2017 observed in the event mode (time-resolution = 0.1s) with NoRH and found that an M8.7 flare on 22 October 2014, clearly showed a high-speed propagation of nonthermal microwave source. We analyzed the SDO satellite (AIA/HMI) data and the ISEE NLFFF Database in addition to the NoRH data. Based on the loop configuration observed with SDO/AIA, the propagation from the middle of a loop toward its footpoint region.

The apparent speed of this propagation is about 72,000 km/s. Using the information of the 3-dimensional coronal magnetic field derived from the NLFFF calculation we estimated that the velocity of the accelerated electrons along the magnetic field lines was about 97,000 km/s. The energy of electrons emitting 17GHz is in the range of a few hundreds keV - a few MeV and their velocity is close to the speed of light. Following the method of Yokoyama et al. (2002), it was found that the pitch angle of the accelerated electrons was about 65 degrees. In this study, we have the information of the magnetic field strength at the starting point of the propagation in the corona and that of the footpoint region. From this information, the size of loss cone is estimated to be about 36 degrees. Considering the pitch angle derived above, most of accelerated electrons are reflected to the corona at the footpoint region. Actually, we found a faint microwave feature which might correspond to a bounce motion of the accelerated electrons. In this presentation we will mainly report the results of microwave data analysis. For a further understanding of this phenomenon, we need analyses of hard X-rays and so on.

Keywords: Solar Flare, particle acceleration, Nobeyama Radioheliograph