Database of solar flare images observed with Nobeyama Radioheliograph

*Satoshi Masuda[1], Keitaro Matsumoto[1]

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

Nobeyama Radioheliograph (NoRH) is a radio interferometer specially designed to observe the full disk of the Sun at 17 and 34 GHz. The National Astronomical Observatory of Japan (NAOJ) successfully operated NoRH from June 1992 to March2015. After that, it was operated by ISEE, Nagoya University as a representative of the International Consortium for the Continued Operation of Nobeyama Radioheliograph (ICCON) until March in 2020.
During this operating period (~28 years), about 900 major flares were observed with NoRH. These flares were recorded with a high time resolution of 0.1 second (event mode), instead of 1 second (normal mode). This high time-resolution is a unique and important characteristic of NoRH. The electron acceleration process during a solar flare takes place impulsively in a shorter time-scale compared with thermal processes such as heating/cooling a plasma, plasma motion, and so on. Thus, the capability of this high time-resolution imaging is quite useful to reveal the acceleration/transport/loss processes of high-energy electrons during a solar flare. For example, Yokoyama et al. (2002) obtained the typical pitch-angle of accelerated electrons through the analysis of the propagation speed of a bright microwave source along a large loop. The typical loop length and electron velocity is < 100 Mm and almost the speed of light, respectively. This means that the propagation time-scale along a flare loop is much less than 1 second. While hard X-ray telescopes such as Yohkoh/HXT, RHESSI and Solar Orbiter/STIX can observe nonthermal emissions from accelerated electrons, their time-resolution is too low to detect this high time-scale propagation. In this sense, NoRH is a unique instrument to make it possible.
Of course, these data can be used for other scientific research topics such as quasi-periodic pulsations (QPPs) in microwave sources, electron precipitation timing at the two ends of a flaring loop, and so on. To increase the scientific results using NoRH, we made a large database including all the images (in fits format) observed in event-mode with NoRH. This database also includes a movie file for each event. It is very helpful to pick up events which are interested in. This database will be open for public at ISEE, Nagoya University soon.

Keywords: Solar Flare, Particle Acceleration, Radio Emission

