Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

PEM05-24 Room:303 Time:May 21 12:20-12:35

High sensitivity hard X-ray imaging and spectroscopy with the Focusing Optics X-ray Solar Imager (FOXSI) sounding rocket

Shin-nosuke Ishikawa[1*], Sam Krucker[2], Steven Christe[3], Brian Ramsey[4], Lindsay Glesener[2], Shinya Saito[5], Tadayuki Takahashi[5], Shin Watanabe[5], Hiroyasu Tajima[6], Takaaki Tanaka[7]

[1]National Astronomical Observatory of Japan, [2]University of California, Berkeley, [3]NASA Goddard Space Flight Center, [4]NASA Marshal Space Flight Center, [5]Institute of Space and Astronautical Science, [6]Nagoya University, [7]Kyoto University

We made an unprecedented high sensitivity solar hard X-ray (HXR) imaging and spectroscopic observation using focusing optics with the Focusing Optics X-ray Solar Imager (FOXSI) sounding rocket, in collaboration with Space Science Laboratory, University of California, Berkeley, and NASA.

Accelerated electrons in solar flares emit HXRs by bremsstrahlung process as they travel and lose their energy in the solar corona. Therefore, HXR observations of the Sun provide important information about the energy release process in solar flares. Although high sensitivity observations of HXRs from accelerated particles in solar flares are important to investigate solar activity and space weather, Fourier reconstructions are required to obtain images with past HXR instruments such as the RHESSI satellite and the Hard X-ray Telescope onboard the Yohkoh satellite, and the sensitivity is limited. To improve the sensitivity, grazing-incidence HXR focusing optics are a promising new technology for future solar observations. By using focusing optics, arrival directions of incident photons can be determined directly, and image reconstructions are not necessary. FOXSI tested out grazing-incidence HXR focusing optics combined with position-sensitive focal plane detectors for solar observations. The replicated nickel optics are used as the focusing optics, and fine pitch silicon strip detectors with low noise front end ASICs (Application Specific Integrated Circuits) are used as focal plane detectors. In the target energy range of 4-15 keV, the angular resolution of optics is 8 arcseconds with the focal length of 2 m. FOXSI achieves superior sensitivity; two orders of magnitude better than that of RHESSI.

FOXSI was launched on November 2, 2012 and HXR images and spectra from a microflare are successfully obtained. We successfully demonstrated the concept of the high sensitivity instrument, and showed the new vision for the future solar HXR observations. In this presentation, we will report the concept of the FOXSI instrument and observational result. We will also present the plan for the second launch opportunity of the FOXSI rocket, and a spaceborne solar observer featuring similar optics we are to propose.

Keywords: the Sun, solar flare, X-ray, particle acceleration