Contribution ID: **9** Contribution code: **INSTR/SW** Type: **Oral**

INSPIRE: exploring MeV gamma ray sky with a small satellite

Wednesday 4 September 2024 14:15 (15 minutes)

Approximately 300 stable elements exist in nature. However, the origin of r-process elements such as Pt, Au, and other rare-earth elements is still under debate. They may have originated in an explosive event, such as binary neutron star mergers called "kilonova", through a rapid neutron-capture process. In the case of a kilonova, 20–50% of the total radioactive energy can be released in the form of gamma rays on timescales of hours to a month. Therefore, various gamma-ray lines are anticipated in the spectra between 30 keV and 3 MeV. However, MeV observations in space are limited, as represented by past observations made by COMPTEL/CGRO in the 1990s and by SPI/INTEGRAL in the 2000s. These giant detectors with mass exceeding 1000 kg require a long development period of over 10 years. In the 2020s, more than 300 small satellites are launched annually, some of which are being used to promote space science. Waseda University and Tokyo Tech are also developing a 75 kg-class small satellite, tentatively named Innovative Space Probe for Imaging R-process Emission, which is scheduled for launch in 2027. The primary detector of the satellite is a BOX-type Compton Camera (CC-Box) that enables the observation of low-energy gamma rays (30–200 keV) in pinhole mode and high-energy gamma rays (150 keV–3 MeV) in Compton mode. The CC-Box is 19 × 19 × 11 cm in dimensions and weighs 10 kg. The CC-Box consists of a pixelized Ce:GAGG scintillator array comprising a depth-of-interaction structure, which is optically coupled to a Si-PM (MPPC) array. Although the CC-BOX is very small and lightweight, its anticipated sensitivity is comparable to or better than that of COMPTEL below 1 MeV. In this presentation, we briefly reviewed the design concept, observational strategy, and performance of the CC-BOX based on a detailed simulation assuming a sun synchronous orbit. Finally, we review the current status of developing an engineering model and various experimental results using the prototype CC-BOX implemented in nuclear medicine and atmospheric observations, such as atmospheric gamma-ray imaging of thunderclouds.

Primary author: Prof. KATAOKA, Jun (Waseda University)

Co-authors: Prof. NAKANISHI, Hiroki (Tokyo Tech); Dr TANAKA, Kazuo (Waseda University); Dr CHUJO, Toshio (Tokyo Tech); Prof. YATSU, Yoichi (Tokyo Tech)

Presenter: Prof. KATAOKA, Jun (Waseda University)

Session Classification: Parallel 2