Solar Neutron and Gamma-ray Observations with a 3U CubeSat

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Solar neutron observations are very important on understanding of particle acceleration mechanism in the Sun. However, previous ground-based observations with large area telescope (~10 m2)at high latitude are not sensitive to solar neutrons due to attenuation in the earth atomsphere and roughly 10 detection since its discovery in 1980 (Chupp et al. 1982). From space, the SEDA-AP instrument with much smaller area (100 cm^2) onboard the International Space Station (ISS) monitored solar neutrons including charged particles, and successfully detected more than 30 detection since its launch in 2009 (Muraki et al. 2014). Unfortunately the SEDA-AP operation was stopped on March 2018. To overcome situation for no mission dedicated for solar neutrons, we have designed and developed a solar neutron and gamma-ray detector for a 3U cubesat with a size of 30x10x10 cm. Actually we launched the 50-kg class ChubuSat-2 satellite for solar neutron observations on February 2016 (Yamaoka et al. 2016), and have now been modifying it to a 3U cubesat application. for the launch in 2021. The solar neutron and gamma-ray detector consists of multi-layered plastic scintillator bars, and GAGG(Ce) scintillator array, and both of them are read out with silicon photo-multipliers (Si PMs). More than 600 signals from Si PMs are processed by IDEAS ASICs. In this paper, we will describe scientific motivation, details of the detector and performance of its breadboard model (BBM).

Keywords: sun, Neutron, gamma-ray, detector, micro-satellite

