R006-49
Zoom meeting B ：11/4 AM2 (10:45-12:30)
11:30〜11:45

Floating-mode avalanche photodiode experiments using low-energy electrons

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Avalanche PhotoDiode (APD) is prevailing for high-energy electron detection with rough energy analyses in space observations. For instance, the electron detector system of the Medium-Energy Particle instrument for electrons (MEP-e) for ERG mission consists of an array of APDs [Kasahara et al., EPS 2018]. Kasahara et al. [NIM, 2012] reported that a minimum detectable energy with an APD is 5keV at 20 ℃.

Our purpose is to reduce the lowermost energy of electron energy analyses with APD and to install APDs in low-energy electron analyzers. In order to detect lower-energy electrons below 5keV, we applied the floating voltage to APD so that the incident electrons could be accelerated up to energies enough large for the APD detection, depending on the difference of voltage. We could detect low-energy electrons even below 5keV by applying up to +5kV as a low-pass filtered floating voltage to the incident surface of APD.

While we could analyze 5keV electrons by about 4keV energy-resolution without the floating voltage at 20 ℃ in our beam line facility, we also confirmed the effect on the total incident energies of the floating voltages by an equivalent energy-resolution. We found that secondary electrons generated by direct impacts of beam line electrons in the vicinity of APD were also accelerated to 5keV by the floating voltage and detected. We also identified another type of secondary electrons generated by beam line electrons back-scattered from APD. These 5keV-electron detections showed that a few-eV electrons were substantially accelerated and successfully energy-analyzed by the floating-mode APD. Our experiments actually indicate that the floating-mode APDs could be applied as low-energy electron detectors with a high-sensitivity and a rough energy analysis capability.