Background and dose estimation for future X-ray observations in the Jovian magnetosphere

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X-ray observations provide significant information on the Jovian magnetospheric dynamics. For instance, images with sufficient angular resolution reveal the spatial extent of transient phenomena, which cannot be obtained by in-situ plasma measurements. The line characteristics also allow us to discuss the ion composition and acceleration mechanisms. Although Earth-orbiting X-ray observatories are powerful tools for planetary X-ray measurements, significant limitation on the spatial resolution, sensitivity, and continuity of observations, cannot be avoidable. Therefore, with near-future X-ray observations inside the Jovian magnetosphere in mind, we have started the design study of a very light telescope with a radiation-hard, pixel solid-state detector. The energy coverage is planned to be from 0.3 to 2 keV and the energy resolution would be about 0.1 keV. During the X-ray observation in the Jovian magnetosphere, incoming (low-energy) particles through the telescope aperture as well as penetrating (high-energy) particles can hit the detector, resulting in the background noise. Since the background count rate is substantial, careful study is required on the efficient shielding structure with minimising the total mass. In order to quantify the background noise and examine the feasibility of the observation, we have conducted a Monte-Carlo simulation (Geant4). With modeled particle fluxes, background count rates and dose rates at the detector were calculated. It was confirmed that the large fraction of the significant background counts can be rejected due to the high energy deposit ($>$5 keV) and long trajectories inside the detector ($>$10 um), which should not be the characteristics of target X-ray signals ($<$2 keV, $<$10 um).