Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **550** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Progress toward optimizing energy and arrival-time resolution with a transition-edge sensor

Thursday 10 June 2021 13:00 (5 minutes)

Superconducting transition-edge sensors (TESs) carried by x-ray telescopes are powerful tools for the study of neutron stars and black holes. Several methods, such as optimal filtering or principal component analysis, have already been developed to analyze x-ray data from these sensors. However, these techniques may be hard to implement in space. Our goal is to develop a lower-computational-cost technique that optimizes energy and time resolution when x-ray photons are detected by a TES. Current pulses, in TESs, exhibit a non-linear response to photon energy. Therefore, at low energies, we focus on the current-pulse height, whereas at high energies, we consider the current-pulse width, to retrieve energy and arrival time of x-ray photons. For energies between 0.1 and 30 keV and with a sampling rate of 195 kHz, we obtain an energy resolution (full-width at half maximum) between 1.32 and 2.98 eV. We also get an arrival-time resolution (full duration at half-maximum) between 163 and 3.85 ns. To improve the accuracy of these results, it will be essential to get a thorough description of non-stationary noise in a TES and develop a robust on-board identification method of pile-up events.

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Session Classification: R2-7 Data Acquisition (DAPI) / Acquisition de données (DPAI)

Track Classification: Applied Physics and Instrumentation / Physique appliquée et de l'instrumentation (DAPI / DPAI)