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Resurrecting Hitomi for X-ray Probes of Sterile Neutrino and Axion-Like-Particle Dark Matter with Blank Sky Observations

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The Hitomi X-ray satellite mission carried unique high-resolution spectrometers that were set to revolutionize the search for sterile neutrino dark matter (DM) by looking for narrow X-ray lines arising from DM decays. Unfortunately, the satellite was lost shortly after launch, and to-date the only analysis using Hitomi for DM decay during its brief, one-month long live time was for data taken towards the Perseus cluster. In this work we present significantly stronger constraints on decaying DM from an analysis of archival Hitomi data towards blank sky locations, searching for DM decaying in our own Milky Way. The soon-to-be-launched XRISM satellite will have nearly identical soft-X-ray spectral capabilities to Hitomi; we project full-mission sensitivity for XRISM for analyses of their future blank-sky data, and we find that XRISM will have the leading sensitivity to decaying DM for masses between roughly 1 to 20 keV. We interpret the projected sensitivity in the context of sterile neutrino and heavy axion-like-particle DM scenarios.

Authors: DESSERT, Chris; NING, Orion; RODD, Nicholas Llewellyn (CERN); SAFDI, Benjamin

Presenter: NING, Orion

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