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Low Temperature MMC-based X-ray Detectors for IAXO

The next generation helioscopes babyIAXO and IAXO will search for evidence of axion and axion-like particles (ALPs) produced in the interior of the Sun. A very promising candidate for the focal plane detectors are low temperature metallic magnetic calorimeters (MMCs). Combining good energy resolution and high quantum efficiency, MMC-based detectors would allow to investigate the solar axion spectrum and derive information on axion models by analyzing the resulting X-ray spectrum beyond discovery. We present our detector system composed of a detector module and an amplifier module, both mounted at the mixing chamber plate of a dilution refrigerator kept at about 10 mK. The detector module contains a 64-pixel chip featuring an absorber area of 1 cm^2 which was optimized to match the BabyIAXO X-ray optics. X-ray absorbers made out of $10 \text{ }\mu\text{m}$ thick gold ensure a high stopping power for the complete energy range of interest while the expected FWHM energy resolution is around 10 eV. The detector signal is amplified with a two-stage SQUID readout circuit. The first stage is positioned directly next to the detector whereas the second stage is implemented with a dedicated amplifier module. Moreover, we discuss our strategies to reach a background level of $10^{-7} \text{ keV}^{-1} \text{ s}^{-1} \text{ cm}^{-2}$ and show ideas of integrating the detector system in the IAXO helioscope mechanical structure.

First author

Daniel Behrend-Uriarte

Email

daniel.behrend-uriarte@kip.uni-heidelberg.de

Collaboration / Activity

IAXO Collaboration

Primary authors: BEHREND-URIARTE, Daniel (Heidelberg University); ABELN, Andreas (Heidelberg University); FLEISCHMANN, Andreas (Heidelberg University); HENGSTLER, Daniel (Heidelberg University); UNGER, Daniel (Heidelberg University); ENSS, Christian (Heidelberg University); GASTALDO, Loredana (Heidelberg University)

Presenter: BEHREND-URIARTE, Daniel (Heidelberg University)

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