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Prototype Magnetic Calorimeter Arrays with Buried Wiring for the Lynx X-ray Microcalorimeter

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Metallic magnetic calorimeter (MMC) technology is a leading contender for detectors for the Lynx X-ray Microcalorimeter, which is an imaging spectrometer consisting of an array of greater than 100,000 pixels. The fabrication of such large arrays presents a challenge when attempting to route the superconducting wiring from the pixels to the multiplexed readout. If the wiring is designed to be planar, then an aggressive, submicron scale wiring pitch has to be employed, which is technically challenging to design and fabricate on account of the requirements of low inductance, low cross-talk, high critical currents and high yield. An alternative way to achieve large scale, high density wiring is through the use of multiple buried metal layers, planarized by Chemical Mechanical Planarization. This approach is well-suited for connecting thousands of pixels on a large focal plane to readout chips, and also for fabricating sensor meander coils with narrow line widths, which helps in increasing the sensor inductance and thus alleviates stray inductance issues associated with the wiring in large size arrays. In this work we describe the fabrication of high sensor inductance MMC arrays implementing Lynx concepts and incorporating multiple layers of buried Nb wiring. The detector array is composed of three sub-arrays with pixels optimized to meet the different science driven performance requirements of Lynx. In two of the sub-arrays we adopt a thermal multiplexing scheme to read out pixels by coupling 25 absorbers to a single sensor through thermal links of varied thermal conductance. We demonstrate the successful fabrication of multi-absorber MMCs with fine pitch pixels in very large size arrays.

Less than 5 years of experience since completion of Ph.D

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