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Results from X-Ray microcalorimeter arrays based on Thermal MKIDs (TKIDs)

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I describe the design, principle of operation and results from our X-ray TKID prototype arrays. These superconducting pair-breaking detectors exploit the ease with which MKIDs can be frequency-domain multiplexed to create large arrays of X-ray microcalorimeters with absorbers that can be close-packed and tiled. Arrays of 20,000+ TKIDs are potentially achievable using frequency domain multiplexing electronics that are similar to those already used to read out 20,000+ pixel MKIDs optical arrays. Sensitivity is controlled by placing absorbers with tuned heat capacity on thermally isolated membranes and by use of low T_c superconductors. Noise, from two-level systems and the readout, is minimized by control of the MKID geometry and use of very low noise amplifiers. Quantum efficiency is tuned by selection of X-ray absorber materials and thicknesses, just as for TES X-ray microcalorimeters. While the energy resolution of past devices is 75 eV at 5.9 keV, we report on progress to achieve 10 eV resolution in forthcoming design iterations. Results include the quiescent performance of individual TKID resonators and initial X-ray pulse data.

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

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