

Small, Fast TES Microcalorimeters with Unprecedented X-ray Spectral Performance

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Driven initially by the desire for X-ray microcalorimeter arrays suitable for imaging the dynamic solar corona, we have developed a transition-edge-sensor (TES) microcalorimeter optimization that exhibits a unique combination of high spectral resolving power and a wide X-ray bandpass. These devices have achieved spectral performance of $dE \sim 1.3$ eV FWHM at 1.5 keV, 1.6 eV at 6 keV, and 2.0 eV at 8 keV, using small TESs (e.g., ~ 35 $\mu\text{m} \times 35$ μm) that operate in a regime in which the superconducting transition is highly current dependent. In order to accommodate high X-ray count rates, the devices sit directly on a solid substrate instead of on membranes, and we use an embedded heatsinking layer to reduce pixel-to-pixel crosstalk. We will present results from devices with a range of TES and absorber sizes, and from device wafers with varied embedded heatsink materials. This contribution will focus on count-rate capabilities, including a discussion of the trade-off between count rate and energy resolution, and the heatsinking design. We will also present preliminary tests of array readout using a code-division multiplexed SQUID readout scheme, which may be necessary to enable large arrays of these fast devices.