Design of high resolution soft x-ray microcalorimeters using magnetic penetration thermometers

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We have designed high-resolution soft x-ray microcalorimeters using magnetic penetration thermometers (MPTs) in an array of pixels covering a total of 2 cm^2, to have a resolving power of 300 at energies around 300 eV. This performance is desirable for studing the soft x-ray background from the warm hot intergalactic medium. MPT devices have small sensor heat capacity and high responsivities, which makes them excellent detector technology for attempting to attain sub-eV resolution. We are investigating the feasibility of pixels with absorbers that are 625 x 625 um^2, up to 1 x 1 mm^2 in area and 0.35 um thick and thinner. Our tests have shown that suspended gold absorbers 0.35 um thick (RRR = 6.7) are feasible to fabricate. We modeled the thermal diffusion from such thin gold over the size of a 625 x 625 um^2 absorber, and conclude that the effect of the thermalization on the resolution of a 300 eV photon is an additional ~0.2 eV FWHM of broadening. We discuss the thermal effects of small absorber attachment stems on solid substrate, as well as considerations for multiplexed readout. We will present the progress we have made towards building and testing this soft x-ray detector.