Development of kilo-pixel arrays of transition-edge sensors for x-ray spectroscopy applications

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We are developing arrays of transition-edge-sensor microcalorimeters for a variety of applications in x-ray spectroscopy. These include future space based x-ray observatories and ground based laboratory experiments. These applications typically require < 3 eV full-width-half-maximum (FWHM) energy resolution in the energy range 0.3-12 keV with arrays incorporating greater than 1000 pixels. In order to practically readout kilo-pixel arrays with the fewest numbers of electronics channels a multiplexer system is required. In this contribution we report on the latest developments and results from kilo-pixel arrays read out using a time-division-multiplexer (TDM) system. In a 32-row TDM configuration, we have demonstrated an average energy resolution of 2.34±0.1 eV at an energy of 1.5 keV (Al-Kα) and 3.3±0.26 eV at an energy of 5.9 keV (Mn-Kα).

Different spectroscopic applications will require different energy resolution, linearity and count-rate accommodation. We are also studying the pixel properties of TESs in different geometric configurations in order to optimize performance for specific applications. We present preliminary studies of devices with different geometric configurations, which include pixel size, position of normal metal features used for transition modification and absorber attachment configuration. Measurements of transition properties, pixel speed and broad-band energy resolution (from 1.5 keV to 12 keV) are presented.