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DEPFET Active Pixel Sensors and pnCCDs for room temperature imaging (Xray) Spectroscopy in space missions and terrestrial astronomy

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Two dimensional back-illuminated (500 μm sensitive thickness) X-ray pixel detectors with pixel sizes from 36 μm , 51 μm , 75 μm to 150 μm have been developed for applications in X-ray astronomy (0.1 keV to 20keV) and for wave front sensing in adaptive optics systems up to 1 μm wavelength in the NIR. In both applications the environmental conditions are such that operation at “warm temperatures” around -30o to -10o C is highly desired simultaneously to high readout speed and low noise operations. During our tests with device formats of 64 \times 64 to 264 \times 264 frame rates of up to 1.000 per second have been achieved with noise floors of 2.5 electrons (rms). For temperatures around - 20o C single stage Peltier cooler can be used, making the system compact and easy to use. The achieved energy resolutions with a pnCCD in the full imaging mode was 210 eV (FWHM) at the MnK α – line at 5.9 keV at - 100 C and with 75 μm pixels and a format of 256 \times 128 being read out at 200 frames per second. The active pixel sensor DEPFET achieved at the same temperature with the same pixel size but with a format of only 64 \times 64 and 300 frames per second an energy resolution of 150 eV only. pnCCD for wave front sensing with a format of 264 \times 528 were operated at 1.000 frames per second and a noise of less than 3 electrons at - 400 C. The full set of measurements will be shown to taste the comfortable parameter space for applications in heaven and on earth.

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