

The DEPFET Detector-Amplifier Structure for Spectroscopic Imaging in Astronomy and for Experiments at Free Electron Lasers

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The DEPFET detector-amplifier structure possesses several unique properties which make it extremely useful as readout element in semiconductor detectors and in particular as building block of semiconductor pixel detectors. Variations of DEPFETs can be tuned to specific requirements as to be sensitive only in predetermined time intervals, to measure signal charge with sub-electron precision, dead-time less readout and DEPFETs with signal compression. These devices have been shown to work in simulations and in prototypes. Now the first two fully developed detector systems have been finished and installed in the MIXS instrument of the Bepi-Colombo Mercury Planetary Orbiter scheduled to be launched in 2016. A further DEPFET detector system under development is the DSSC that will be installed in one of the beam-lines of the XFEL. The requirements on the two projects are rather different. While the MIXS sensors are supposed to measure precisely the energy and position of single photons down to very low energies but at moderate rates, the DSSC has to measure the number of photons arriving in each pixel within a time interval of 220 ns. Here the challenge is the capability of detecting single X-ray photons in one pixel simultaneously with up to 10.000 photons in some other pixels. Device functioning has been verified with sensors produced in a research laboratory. Now process and design have been adapted to an industrial type production line, allowing additional improvements.

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