

High Dynamic Range CMOS Image Sensors

Supervision team:

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Description:

High dynamic range (HDR) image sensors are used when the difference in light intensity within a scene or between different operating conditions is very large, for example imaging a dim object next to a bright one, or imaging at night and during the day. HDR is required for many demanding applications such as automotive imaging, robotics and surveillance. Image sensors for high-performance scientific applications are markedly different from industrial or consumer devices, but many require and would benefit from increased dynamic range, for example in astronomy, spectroscopy and space-based imaging.

This project aims to develop HDR CMOS image sensors for scientific applications with signal to noise ratio greater than 10^5 . In collaboration with our industrial partner Teledyne e2v, the Centre for Electronic Imaging (CEI) has developed patent-pending methods of achieving HDR using a single image exposure. We are now working towards designing and manufacturing prototype devices and the experimental verification of the operating principles. This studentship can make a valuable contribution to the development of the technology for future use in space- and ground-based scientific imaging.

The work will involve experimental characterisation, data analysis, semiconductor device simulations and elements of image sensor design. The aim is to fully characterise and understand the operation of the sensors and to link the data with the scientific requirements. Using the experimental data in combination with the expected performance from device simulations could provide input to the designs of new image sensors. The outcomes of this studentship will be directly applicable to the future space missions the CEI and Teledyne e2v are involved with, and will help develop new sensors for astronomy, Earth observation and Solar system exploration.

The successful candidate will benefit from training in experimental methods for image sensor characterisation, CMOS circuit operation and design, and semiconductor device simulations using TCAD tools. The student will also benefit from support by experienced engineers at Teledyne e2v and will obtain an understanding of working in an industrial environment.

Qualifications required: A first class or upper second class MSc degree in physics, electronics engineering or a related discipline.