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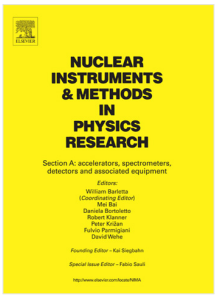

Direct imaging detectors for electron microscopy

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Direct Imaging Detectors for Electron Microscopy.

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Abstract

Electronic detectors used for imaging in electron microscopy are reviewed in this paper. Much of the detector technology is based on the developments in microelectronics, which have allowed the design of direct detectors with fine pixels, fast readout and which are sufficiently radiation hard for practical use. Detectors included in this review are hybrid pixel detectors, monolithic active pixel sensors based on CMOS technology and pnCCDs, which share one important feature: they are all direct imaging detectors, relying on directly converting energy in a semiconductor. Traditional methods of recording images in the electron microscope such as film and CCDs, are mentioned briefly along with a more detailed description of direct electronic detectors. Many applications benefit from the use of direct electron detectors and a few examples are mentioned in the text. In recent years one of the most dramatic advances in structural biology has been in the deployment of the new backthinned CMOS direct detectors to attain near-atomic resolution molecular structures with electron cryo-microscopy (cryo-EM). The development of direct detectors, along with a number of other parallel advances, has seen a very significant amount of new information being recorded in the images, which was not previously possible – and this forms the main emphasis of the review.

Keywords: Direct detectors; Electron Microscopy; Imaging detectors; Electron cryo-microscopy; CMOS detectors

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