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Fast and Wide Dynamic Range X-ray Detectors Enable Novel Science

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New and improved synchrotron radiation sources enable experiments that demand the ability to acquire successive hard (e.g., 10 keV) x-ray images at sub-microsecond rates or to quickly acquire x-ray patterns encompassing intensities that vary by 10^6 or more across single images. We describe two novel integrating Pixel Array Detectors (PADs) developed at Cornell University that accomplish these objectives. The Mixed-Mode PAD (MM-PAD) frames at > 1 KHz and can readily detect signals within a single image ranging from single x-rays to over 10^7 x-rays/pixel/frame. The Keck-PAD can acquire 8-12 successive images at frame rates approaching 10 MHz with a range of single x-rays up to about 10^4 x-rays/pixel/frame. The operating principles of the MM-PAD and Keck-PAD, respectively, are described. We also describe examples of experiments that have been performed at various synchrotron radiation sources.

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