Réunions scientifiques

Séminaires

Séminaire SOLEIL

X-ray Detector Development at Berkeley Lab.

Peter DENES

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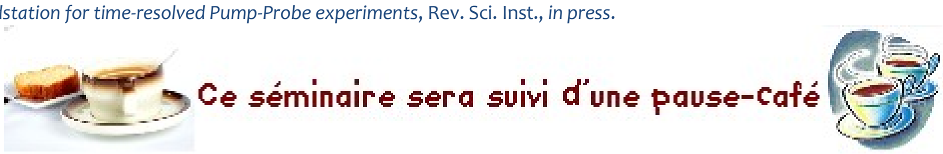
Invité par Stéphanie HUSTACHE et la section MMI

Lundi 5 décembre à 14h00
Grand Amphi SOLEIL

"Moore's Law" predicts[1] a doubling of the number of transistors per unit area roughly every 2 years. Synchrotron radiation light sources have done twice as well: doubling their performance measure – *brightness* – roughly every year. That means that our ability to *use* photons is falling exponentially behind our ability to *make* them.
Berkeley Lab has been building microelectronic-enabled detectors for more than 20 years, with particular interests in silicon strips, pixels and Charge-Coupled Devices (CCDs). At the Microsystems Laboratory, we have developed thick, fully-depleted CCDs[1], which have near unity efficiency for X-rays up to 8 keV. Together with a suite of custom integrated circuits, this has allowed us to provide novel high-speed 2D detectors for photon and electron microscopies.
We have developed fast (hundreds of megapixel frames/second) direct detection X-ray CCD cameras, and in collaboration with the Advanced Photon Source (APS) have deployed several prototype systems[1]. These initial systems have been used for soft X-ray ptychography, photon correlation spectroscopy and microdiffraction at ALS and APS, as well as soft X-ray scattering at LCLS[1]. Larger, more sophisticated systems are currently being built, and will be described. R&D is also under way on ultra-thin backside contacts in order to maximize low energy X-ray quantum efficiency, as well as a next generation of high-speed direct-detection CCD, designed for 10^3 – 10^4 frames/second.
As ALS is primarily a soft X-ray facility, our focus is on the challenges of soft X-ray detectors. CMOS active pixels, grown on thick high-resistivity silicon, offer attractive prospects for new X-ray detectors, and we are just deploying a 4,000 frame/second gated detector for use at ALS femtoslicing beamline. For soft X-rays, thinned bulk CMOS active pixels, with backside contacts, together with advances in data compression and processing, offer a potential approach to reach rates of 10^5 frames/second. All of the techniques mentioned above are applicable for photoelectron detection as well.

[1] G.E. Moore, *Cramming more components onto integrated circuits*, Electronics, **38** (1965)
[1] S. E. Holland, D. E. Groom, N. P. Palaio, R. J. Stover, and M. Wei, IEEE Trans. Elect. Devices, **50**, 225-238 (2003)
[1] P. Denes, D. Doering, H. A. Padmore, J.-P. Walder, and J. Weizeorick **,** *A fast, direct X-ray detection charge-coupled device*, Rev. Sci. Inst, **80**, 083302 (2009)
[1] D. Doering, Y.-D. Chuang, N. Andresen, K. Chow, D. Contarato, C. Cummings, E. Domning, J. Joseph, J.S. Pepper, B. Smith, G. Zizka, C. Ford, W.S. Lee, M. Weaver, L. Patthey, J. Weizeorick, Z. Hussain, and P. Denes, *Development of a Compact Fast CCD Camera and Resonant Soft X-ray Scattering Endstation for time-resolved Pump-Probe experiments*, Rev. Sci. Inst., *in press*.



Formalités d'entrée *: accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi Soleil du Bâtiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).*

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