High-frequency Nano-motion Imaging of Artificial Nanostructures

T. Liu[1], J. Y. Ou[1], K. F. MacDonald[1] and N. I. Zheludev[1, 2]

[1.] *Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, Highfield, Southampton, SO17 1BJ, UK*

[2.] *Centre for Disruptive Photonic Technologies, School of Physical and Mathematical Sciences and The Photonics Institute, Nanyang Technological University Singapore, 637378, Singapore*

There is growing interest and technological opportunity in nanomechanics and the fundamentals of nano- to pico-scale dynamics, which derive from the fact that electromagnetic and quantum forces become stronger as the dimensions of objects decrease, competing with elastic forces at sub-micron scales; while movements become faster as mass decreases, achieving Gigahertz bandwidth at the nanoscale.

We report on a novel approach to the visualization of such movements that is based on the detection of secondary electrons and photons emerging from the interaction of a focused electron beam with moving components of nano-objects. The technique extends the static (zero-frequency) imaging capabilities of a conventional scanning electron microscope to enable hyperspectral spatial mapping of fast (MHz-GHz) thermal and externally-driven nano- to pico-scale motion in nanostructures.