MS41-O2 X-ray imaging of single nano-structures: from focused beams to coherent imaging and ptychography

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The quantitative study of nano-structures has seen remarkable developments in the last 20 years, either using electron microscopy or synchrotron X-ray beams. The latter notably allow to study the structure of single objects with a resolution around 10 nm, giving access not only to the 2D and 3D electronic density, but (using the Bragg geometry) to the inhomogeneous strain of deformed crystal lattices.

We will present examples of X-ray nano-diffraction studies notably on semi-conductor nano-structures: (i) 70nm-thick silicon-on-insulator (SOI) lines and layers, where the strain is used to enhance the conductive properties, and (ii) GaAs nanowire with embedded InAs quantum dots used as source for single photon emission.

Finally, we will also discuss the future of coherent imaging techniques, which will become more accessible with the development of more user-friendly algorithms and software for data analysis, and the prospect of more brilliant sources giving several orders of magnitude improvement in the available coherent flux.

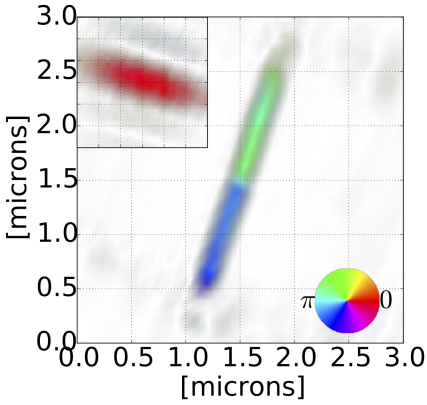

Figure 1. Reconstruction of a GaAs nanowire with an ~1.7 monolayer InAs insertion in Bragg geometry. The brightness corresponds to the amplitude, the colour to the phase of the complex image - corresponding to a ~0.027nm shift of the crystalline lattice. Inset: reconstructed X-ray probe.