Coherent X-rays: high-resolution imaging for all

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The use of coherent X-rays for imaging has been steadily increasing for the past 25 years, from phase contrast imaging to coherent diffraction and ptychography experiments, resulting in two and three-dimensional material inspection with a spatial resolution down to about 10 nanometers. This progress will soon be enhanced by the Extremely Brilliant Source upgrade, leading to an improved spatial and temporal resolution. However for a long time coherent diffraction techniques were mostly used by a limited community as much focused on the methodology than on the materials.

I will present the various techniques which can be used for standard small-angle imaging, yielding the sample's electronic density, with applications from brain imaging to fuel cells, as well as those in the Bragg geometry, giving access to strain information, e.g. for semi-conductor nano-structures or catalysts. Most importantly I will show how algorithms and data processing have improved during the last few years, providing a more robust data analysis which can be performed with limited supervision or hand-tuning. Additionally, efforts on a more efficient use of modern computing resources allows much faster two or three-dimensional reconstructions, both during and after the experimental time. These advances, along with the improved photon flux, should pave the way for the application of high-resolution coherent imaging techniques with a larger community.