X-ray Scattering in full-field imaging and near-field ptychography

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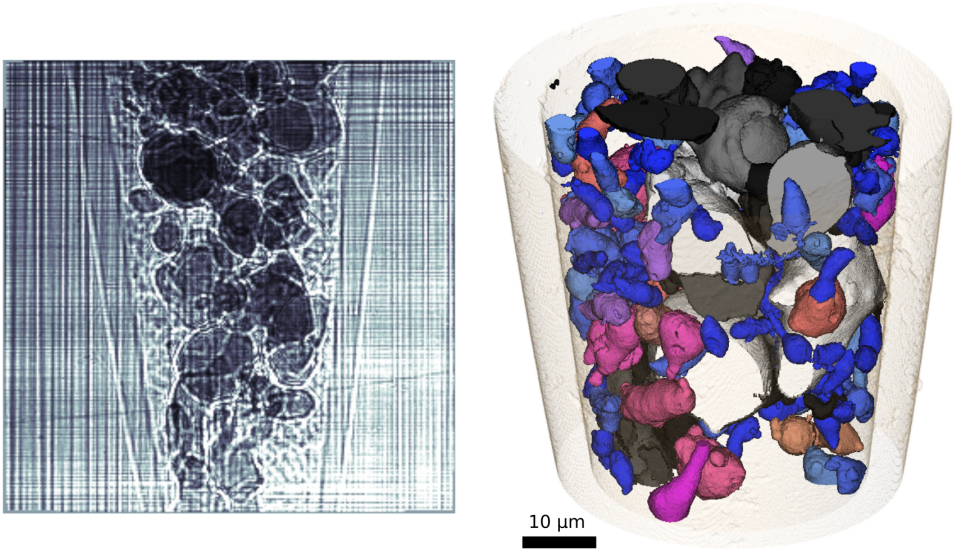
For imaging applications, the scattering of X-rays by different materials is often considered a nuisance that causes deterioration of the images or reconstructed 3D volumes. Yet, coherent and incoherent scattering may carry crucial information on the structure of a sample, in particular at scales smaller than the resolving power of the imaging apparatus. The goal of this project is to develop, validate and apply new scattering-aware X-ray imaging methods. Impact of this research ranges from industry (e.g. carbon fibre composites) to biomedical research (e.g. collagen structure and microcalcifications).

This project is funded by the ERC Consolidator Grant on the theme of “Scattering-Based X-ray Imaging and Tomography (S-BaXIT)”, hosted by the University of Trieste and the Synchrotron Elettra. The focus of the research activities will be on advanced algorithmic methods applied to imaging and tomography.

In this project, the student will work on new X-ray techniques that exploit information encoding in coherent X-ray beams. In particular, the successful candidate will (1) develop X-ray scattering simulation models; (2) plan and participate in experiments in the lab and in synchrotron radiation facilities; and (3) manage collaborations with European partners for applications of scattering-aware tomography with relevant biomedical, geological and palaeontological samples. In addition to regular measurement runs done at Elettra and other synchrotron radiation facilities, a high-brilliance liquid-metal-jet source will be used for lab-based experiments.

The candidate should have a good background in optics and atomic physics. Good programming skills (ideally in python or C/C++) and experience with X-ray or imaging equipment are valuable but not essential.

Interested candidates are encouraged to contact Prof. Thibault (pthibault@units.it) well before the university application deadline (7 June 2021).



High-resolution X-ray near-field ptychography and tomography on an Aluminum Nickel powder sample. Left: one of the diffraction patterns. Right: tomographic reconstruction.