X-ray Phase Contrast Tomography: Advanced technique for advanced investigation

Alessia Cedola
Institute of Nanotechnology- CNR- Rome

New science supported by new technology is necessary in precision medicine for the comprehension of disease mechanisms and monitoring of therapeutic approaches to achieve an outstanding breakthrough, in particular in the field of autoimmune, oncological, and neurodegenerative diseases. In particular neurodegenerative diseases necessitates in-depth investigation of disease mechanisms both in whole CNS and at cellular level. The tools available today do not meet these requirements. Although jumping from 2D to 3D represented an outstanding breakthrough in the quality of imaging and information obtained, conventional tomography, magnetic resonance and X-ray-computed tomography, fail to provide a satisfactory answer to the unmet medico-imaging needs for these diseases.

X-ray phase contrast tomography (XPCT) is an advanced non-destructive 3D multi-scale direct imaging from the cell through to the whole organ, with exceptional spatial and contrast resolution. XPCT emerges as added-value technology to explore biomedical tissue as a whole, preserving tissue chemistry and structure, enabling the comparison of physiological vs. pathological states at the level of crucial disease targets. In-vivo translation will permit to monitor emerging therapeutic approaches and possibly shed new light on pathological mechanisms of several diseases.

A great improvement in the field of material science comes from the ability of XPCT to direct detect small details inside the sample and to distinguish details with similar density, in a multiscale approach.

Since in perspective this new imaging technique should be available in the best research centers and not dependent on the accessibility of Synchrotron facilities, the ATOM project provides for the implementation of a advanced dedicated laboratory for XPCT. ATOM is a groundbreaking project opening new horizons in biological, medical and material science 3D X-ray imaging, which will boost the reformulation of X-ray tomography. Atom will offer a facility equipped with this advanced technique for advanced investigation in a wide range of applications.