



Origins, state-of-the-art and application perspectives of incoherent x-ray phase contrast imaging methods

Tuesday January 22, 2019
1:00-2:00 pm, QNC 1501

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Abstract

X-ray phase contrast imaging (XPCI) has been one of the hot topics in x-ray research over the last two decades, because of its potential to revolutionize applications of x-rays in medicine and beyond. However, translation into everyday use in hospitals and other “real-world” environments has proven difficult. One possible reason for this is the fact that all XPCI methods proposed so far have been based on coherent approaches, which typically leads to flux limitations when implementations outside specialized facilities such as synchrotrons are pursued.

This talk will focus on an alternative approach based on incoherent sample illumination. This was obtained through an adaptation to polychromatic and divergent x-ray beams (via apertured masks) of the “edge-illumination” principle, developed at the Elettra Synchrotron in Italy in the late ‘90s. The talk will introduce the method, and explain how it allows achieving phase sensitivities comparable to that of coherent approaches while using unfiltered and uncollimated focal spots of up to 100 micron in size. The method’s flexibility, leading to easy adaptation to e.g. tomosynthesis, microscopy and micro-CT, will be discussed, alongside its extension to “dark-field” (sometimes referred to as “ultra-small angle scattering”) approaches. Finally, a series of applications to medicine and other fields will be discussed, with particular focus on the prototyping activities currently underway in collaboration with various companies.

Bio

Alessandro (“Sandro”) Olivo is Professor of Applied Physics with the Department of Medical Physics and Biomedical Engineering at University College London (UCL), and the spokesperson of the Advanced X-Ray Imaging (AXIm) Group (<https://www.ucl.ac.uk/medphys/research/axim>). He graduated summa cum laude from the University of Trieste in 1995, did a PhD at the same university after a short stint as a hospital physicist, and moved to UCL in 2005 thanks to a EU-funded Marie Curie Fellowship. Here he started to focus on the translation of advanced synchrotron methods into standard lab settings, and set up a dedicated group thanks to two additional individual fellowships and a number of research grants awarded by public bodies, charities and industry. Overall he has worked in x-ray imaging for over 20 years, and is considered a pioneer in the field of X-ray phase contrast imaging, having co-designed the in vivo mammography system operational at the Trieste synchrotron and invented the “edge-illumination” and “coded-aperture” methods. He has been awarded >£12M in research funding, published >200 papers, and given >100 conference talks/seminars, 68 of which were invited. Articles on his work appeared, among others, in Nature, Scientific American, Physics Today, Physics World.

Keywords: imaging, phase contrast X-ray, tomography, microscopy, dark-field

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