Contribution ID : **68** Type : **Oral**

X-ray dark-field imaging without optics

Wednesday, 24 November 2021 14:15 (15)

X-ray image contrast can be generated via three mechanisms: (i) attenuation, (ii) phase contrast and (iii) most recently, the dark-field signal, which arises due to the incoherent scattering of the incident x-ray wavefield by unresolved sub-pixel features (microstructure) present in the sample. These contrast mechanisms can be realised using emerging x-ray imaging techniques, such as analyser-based and grid-based imaging, each of which require the use of specialised optics and carefully aligned setups. In this work, we focus on a technique which has not been used to capture quantitative dark-field contrast – propagation-based imaging. Propagation-based imaging requires no specialist optics and operates on the principle that phase variations induced in the x-ray wavefield by the sample manifest as intensity variations at the detector plane, some metres downstream, due to the self-interference of the wavefield. We describe a new approach to analysing propagation-based images, derived from the x-ray Fokker-Planck Equation, which enables dark-field images to be extracted. All that is required is two exposures, captured at two different propagation distances, which enable our algorithm to separate phase and dark-field effects to recover sample thickness and microstructure distribution. We demonstrate, using images captured at the Australian Synchrotron's Imaging and Medical Beamline, that it is possible to capture dark-field images without having to introduce specialised optics or spend extensive time on optics alignment. This new technique could be applied to study biomedical microstructures, like the alveoli in the lung, or manufactured parts, capturing porosity or carbon fibre.

Level of Expertise

Student

Presenter Gender

Man

Pronouns

He/Him

Which facility did you use for your research

Australian Synchrotron

Students Only - Are you interested in AINSE student funding

Yes

Do you wish to take part in the Student Poster Slam

No

Condition of submission

Yes

Primary author(s) : Mr LEATHAM, Thomas (Monash University)

Co-author(s) : Prof. PAGANIN, David (School of Physics and Astronomy, Monash University); Dr MORGAN, Kaye (Monash University)

Presenter(s) : Mr LEATHAM, Thomas (Monash University)

Session Classification : Instruments & Techniques

Track Classification : Instruments & Techniques