Offered Master thesis project in X-ray Optics group	
Principal Investigator:	Dr. Jürgen Mohr
Institute	Institute of Microstructure Technology (IMT), Karlsruhe Institute of Technology
Research group	X-ray Optics (Emerging X-ray optics project) https://www.imt.kit.edu/x-rayoptics.php
Duration	6 months
Topic	Image reconstruction in single-shot X-ray imaging using two-dimensional gratings
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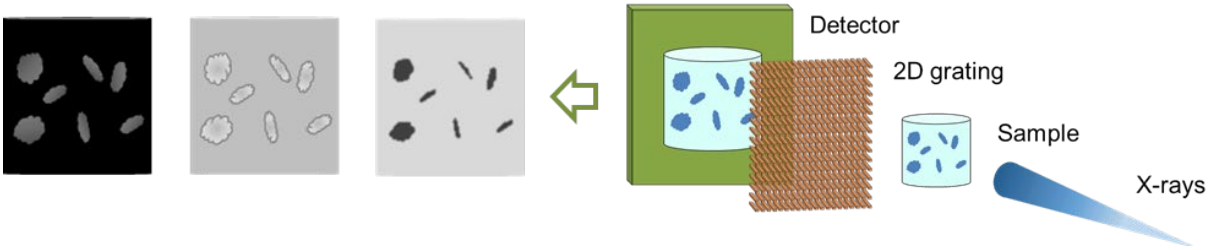
At KIT/IMT emerging X-ray optical components are developed to broaden the capabilities of imaging techniques. Optical components such as gratings allow performing phase-contrast imaging, which offers enhanced information about inner structure of the various objects in addition to conventional attenuation contrast. This contrast is due to physical phenomena of refraction and scattering of X-rays while passing though the object under investigation.

Non-interferometric wave front sensing methods have been proposed recently to perform phase and scattering contrast retrieval via single projection image within simplified setup [1]. Single-shot setup configuration, apart from micro focus X-ray tube and X-ray camera, includes single two-dimensional grating to provide enhanced information on material structure in several directions ensuring thorough characterization of the object under investigation. In this approach the incident beam is periodically modulated by a single absorption grating, and the distortion of the regular pattern introduced by the object is recorded with single exposure and then analyzed. One of the possible algorithms to retrieve three contrast modalities from the grating-object image is based on the spatial harmonic imaging approach (or it's modification – spatial frequency heterodyne imaging) [2-3], where the image at the detector, which is the convolution of the object and the grating images, is Fourier-transformed to a spatial frequency spectrum (or analyzed in terms of heterodyning frequency signal processing). This spectrum is the sum of a series of harmonic spectra that can be separated to yield all three contrast modalities.

In this Master thesis a script for retrieval of scattering and phase information from radiographic projection will be developed using experimental data. You will be a part of highly motivated and friendly team working with an experienced supervisor in order to contribute to a cutting-age research project and present an impressive work for your Master thesis.

Requirements: experience in programming in Python or MATLAB, basic knowledge of Fourier analysis.

Keywords: image reconstruction, single-shot imaging, X-ray gratings



Literature

[1] H.Wen et al, Optics Letters 35 1932-1934 (2010)
[2] B. Wu et al, Applied Physics Letters 100 (2012) 061110.
[3] D. Rand et al, Scientific Reports 15673 (2015).