Bachelor- & Mastertheses

X-ray phase-contrast imaging

ERLANGEN CENTRE FOR ASTROPARTICLE PHYSICS

X-ray phase-contrast imaging is an advanced X-ray imaging method, which yields additional image information. By use of a Talbot-Lau interferometer we are sensitive to small phase shifts of the impinging wave front caused by an object. Thus, the method provides access to the sample's complex refractive index, i.e. to both the attenuation and the refractive properties.

By this method three image modalities are obtained, the attenuation, the differential phase and the dark-field image (e.g. in Fig. 1). The latter covers signals generated by small angle scattering off micrometre sized fibres or granular structures. This leads to advantages in e.g. mammography and diagnosis of lung diseases. Moreover, the dark-field image is promising for non-destructive materials testing. Fine cracks or air inclusions are easy to detect due to scattering effects while their small density variations result in only a weak signal in the conventional attenuation image.

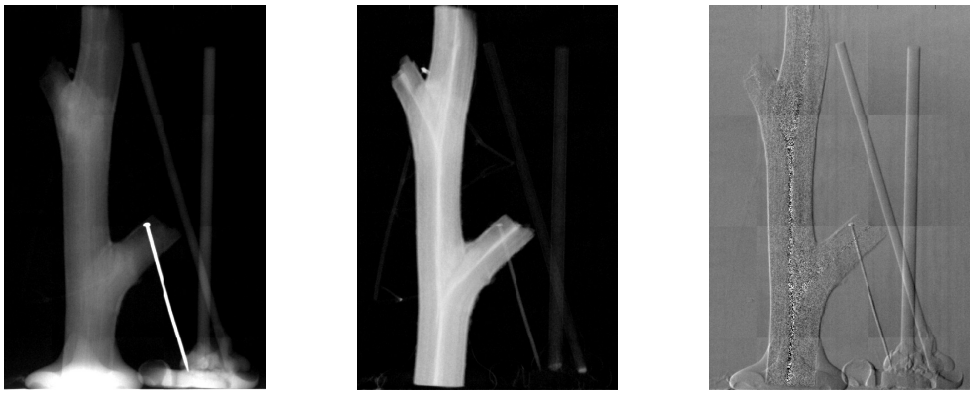

Fig. 1: Attenuation (left), dark-field (middle) and differential phase (right) images of a small branch, a grass stalk , two carbon fibre rods and a metallic needle, fixed with hot glue.

Possible topics for bachelor or master theses:

- Evaluation of X-ray phase-contrast imaging for application fields in medical imaging or non-destructive materials testing
- Measurement and analysis of medical samples and materials
- Further development of the simulation framework and implementation of new setup ideas
- Optimization of reconstruction algorithms and methods for structural analysis

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