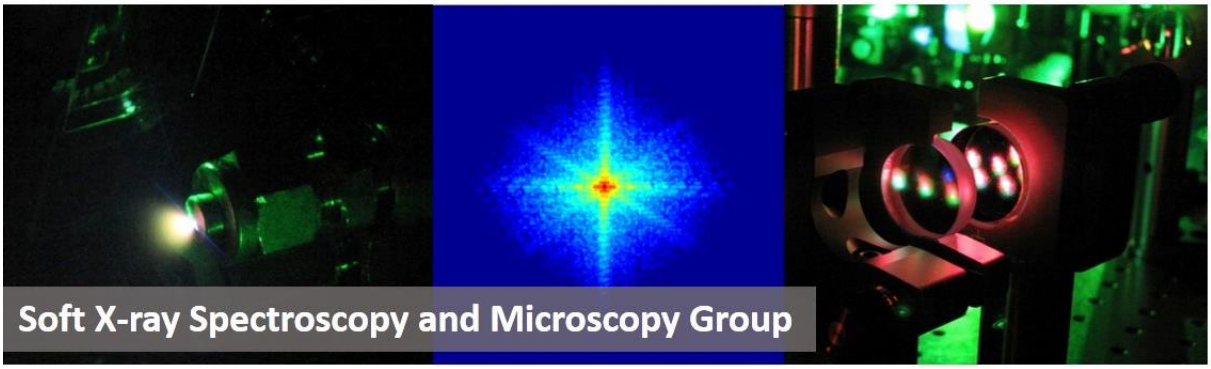

Exploring broadband lens-less imaging with Ptychography

Ptychography is a scanning microscopy technique that has recently enabled the highest resolution x-ray and electron micrographs ever produced [1-3]. Moreover, it has unlocked unprecedented capabilities in the field of beam diagnostics, in particular in regimes of the electromagnetic spectrum where wavefront characterization is challenging [4,5]. Ironically, all of these results have not been driven by ever-increasing precision of optical elements, but instead with lens-less imaging setups and relatively few optical components.
The “dirty work” was carried out by data-driven numerical analysis. We are searching for an experimentally affine master candidate with Python or MATLAB programming skills to explore the possibilities of broadband ptychography. You will build up a visible-light ptychography setup with the goal to explore the limits of polychromatic operation. The project will allow you to gather experience both in experimental lab work and modern data science.
Utilizing wider portions of the illumination spectrum would open up possibilities to apply this technique for ultrafast and element-specific imaging using XUV tabletop sources. The insights from your thesis can be put to practice at an existing XUV ptychography setup in our group.

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[3] Holler, Mirko, et al. "High-resolution non-destructive three-dimensional imaging of integrated circuits." *Nature* 543.7645 (2017): 402-406.
[4] Tadesse, Getnet K., et al. "Wavelength-scale ptychographic coherent diffractive imaging using a high-order harmonic source." *Scientific reports* 9.1 (2019): 1-7.
[5] Loetgering, Lars, et al. "Generation and characterization of focused helical x-ray beams." *Science advances* 6.7 (2020): eaax8836.

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