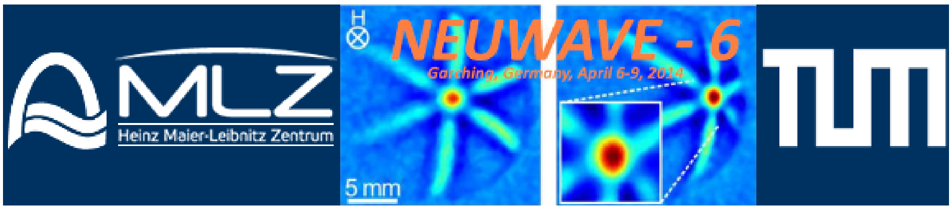

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A Neutron grating interferometer for the ANTARES Beamline and possible applications on domain imaging in superconductors.

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Neutron grating interferometry (nGI) is an advanced neutron radiography method based on the Talbot-Lau effect which allows a simultaneous recording of differential phase contrast (DPC) as well as dark field images (DFI) in addition to the neutron transmission image (TI) [1] [2]. The setup consists of three different neutron phase and absorption gratings installed at a conventional neutron imaging beamline. DFI, DPC and TI are calculated out of a sequence of detector images taken during a stepping scan of one of the gratings. The applications range from phase contrast and dark-field radiography or tomography as a tool for material differentiation to the observation of domain walls in ferromagnetic materials like transformer sheets or even more bulky samples [3].

Because of the one-dimensionality of the grating array, the method is only sensitive to scattering and phase shift components perpendicular to the grating lines. To extract the complete scattering information a rotation of the sample around the beam axis is therefore necessary which has recently been shown in x-ray grating interferometry. [4]

Unfortunately, a rotation of the sample is not always possible in case of oversized samples or a complex sample environment connected to the sample position. To circumvent these problems an nGI setup was constructed, which allows a simultaneous rotation of all three gratings without changing the Talbot distance or the alignment of the phase to the analyzer grating and therefore avoids a readjustment of the interferometer after rotation.

In the first part of our contribution we will discuss some of the properties and design characteristics of the new setup. In addition, we will show results of a new approach for the fabrication of the analyzer grating using Gd sputtering instead of Gd evaporation. This nGI setup will be implemented at the ANTARES beamline as user instrument.

In the second part we will explain possible applications and advantages of this method on the example of neutron dark field imaging of domain structures in superconducting material. For such experiments a combination of the nGI method with a cryostat and a magnet is necessary. Investigations of this kind will highly benefit from the new setup and the extensive sample environment at FRM II.

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