Advances in neutron tomography

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Abstract. In the last decade neutron radiography (NR) and tomography (NCT) have experienced a number of improvements, due to the well-known properties of neutrons interacting with matter, i.e. the low attenuation by many materials, the strong attenuation by hydrogenous constituent in samples, the wavelength-dependent attenuation in the neighbourhood of Bragg edges and due to better 2D neutron detectors. So NR and NCT were improved by sophisticated techniques that are based on the attenuation of neutrons or on phase changes of the associated neutron waves if they pass through structured materials.

Up to now the interaction of the neutron spin with magnetic fields in samples has not been applied to imaging techniques despite the fact that it was proposed many years ago. About ten years ago neutron depolarization as imaging signal for neutron radiography or tomography was demonstrated and in principle it works. Now one can present much improved test experiments using polarized neutrons for radiographic imaging. For this purpose the CONRAD instrument of the HMI was equipped with polarizing and analysing benders very similar to conventional scattering experiments using polarized neutrons. Magnetic fields in different coils and in samples (superconductors) at low temperatures could be visualized. In this lecture a summary about standard signals (attenuation) and the more 'sophisticated' imaging signals as refraction, small angle scattering and polarized neutrons will be given.

Keywords. Neutron imaging; neutron tomography.

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