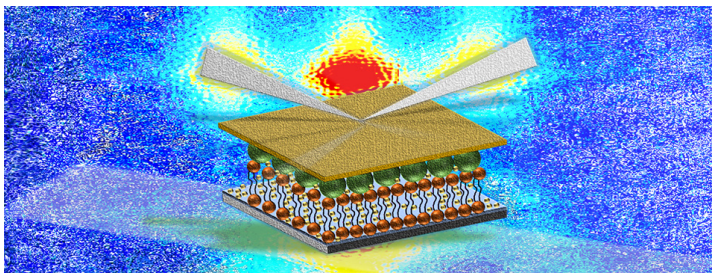

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# Magnetic correlations in ion implanted metamaterials probed by neutrons

*Mittwoch, 9. Oktober 2024 11:45 (15 Minuten)*

Investigating the magnetism at interfaces with designed periodic modulation of the magnetization—known as magnetic metamaterials—has recently gained significant attention [1]. Such structures provide platforms for fundamental studies of order and dynamics at the mesoscale, as well as having potential applications such as computation [2]. The magnetism in these materials can be studied by real space techniques, such as magnetic microscopy employing polarized photon beams or scanning probe techniques. All these techniques have in common that they are local while the collective behavior of these metamaterials may be studied with scattering techniques offering complementary information. Neutrons are directly sensitive to the magnetic induction in materials and reflectometry allows to extract the magnetisation depth profile accross surfaces and interfaces [3], while off-specular and grazing incidence scattering [4] allows the study of lateral correlations on orders of length scales from nm up to around 100 µm.
In this work, we present a feasibility study performed on a new generation of magnetic metamaterials, produced using an additive approach based on ion implantation [5][6]. The resulting metamaterial architectures comprise chemical patterns on otherwise flat films, where the implanted species induce magnetism to a paramagnetic host matrix. By employing an electron beam lithography process, we define the lateral implantation patterns. We then characterize the implanted magnetization profiles using polarized neutron reflectivity (PNR) and present lateral magnetic order information through a grazing incidence small-angle neutron scattering (GI-SANS) measurement protocol.

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