Ordering and frustration in artificial magnetic patterns

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We have recently investigated patterned magnetic nanostructures with different shapes and symmetries for the exploration of magnetization reversal mechanisms and of correlation effects via dipolar or exchange interaction. With the choice of materials and shapes a complete control is possible over the remanent state, the coercivity, and the type of reversal via domain wall motion or coherent rotation. Nanostructures were prepared by e-beam lithography and by ion beam modification of interfaces between ferro- and antiferromagnetic layers. The magnetic patterns investigated include magnetic stripes and dipolar arrays, triangular structures, open and closed window structures, islands, spirals, and Kagomé lattices. The magnetization reversal was studied by longitudinal vector MOKE in specular geometry as well as in Bragg MOKE geometry, using the diffraction spots from the grating for hysteresis measurements. In addition, we have carried out polarized neutron scattering (PNR) and soft x-ray resonant magnetic scattering (XRMS) to determine correlation effects during the magnetization reversal. The measurements are compared with results of micromagnetic simulation, which allows a detailed interpretation of the experimental data. An overview will be given and recent results will be discussed.

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