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Novel Quadratic X-Ray Magneto-Optical Effect for Time-resolved Experiments at the M Edges of the 3d Transition Metals

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We have observed a quadratic x-ray magneto-optical effect in near-normal-incidence reflection at the M edges of iron [1]. The effect appears as the magnetically induced rotation of ˜0.1° of the polarization plane of linearly polarized x-ray radiation upon reflection. A comparison of the measured rotation spectrum with results from x-ray magnetic linear dichroism data demonstrates that this is the first observation of the Schaefer-Hubert effect in the x-ray regime. Ab initio density-functional theory calculations reveal that hybridization effects of the 3p core states necessarily need to be considered when interpreting experimental data. The discovered magneto-x-ray effect holds promise for future ultrafast and element-selective studies of ferromagnetic as well as antiferromagnetic materials.

[1] S. Valencia, A. Kleibert, A. Gaupp, J. Rusz, D. Legut, J. Bansmann, W. Gudat, and P. M. Oppeneer, Phys. Rev. Lett. 104, 187401 (2010)

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