

X-FEL nanoscale imaging of ultrafast magnetization dynamics

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An important problem in modern magnetism research is the understanding of the excited states. In particular laser-based experiments have investigated fundamental excitations in the femtosecond time regime and have shown fascinating effects like ultrafast demagnetization [1] and all-optical switching [2]. While optical pump-probe techniques allow for ultrafast excitations and the study of their evolution on the macroscopic scale, processes on the nanometer length scale are blurred because of the lack of real or momentum space resolution of optical techniques. Utilizing resonant magnetic scattering, the length and the time scales of magnetic excitations by an optical pump can be uniquely probed with ~ 100 femtosecond intense X-FEL probe pulses. The path towards capturing the excited state in a femtosecond single-shot will be elucidated.

References

- [1] E. Baurepaire, et al., Phys. Rev. Lett. 76, 4250 (1996).
- [2] C.D. Stanciu, et al., Phys. Rev. Lett. 98, 207401 (2007).