

The X-Ray View of Ultrafast Magnetism

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Polarized soft x-rays have been used over the past 20 years to obtain fascinating new insights into nanoscale magnetism. The separation of spin and orbital magnetic moments, for instance, enabled detailed insights into the interplay of exchange and spin-orbit interactions at the atomic level. The now available polarized soft x-ray pulses with only 100 fs duration allow us to observe the magnetic interactions at work in real time. The ultimate goal of such studies is to understand how spins may be manipulated by ultrashort magnetic field, spin polarized current or light pulses. In this talk I will focus on fs laser induced spin-orbit dynamics in 3d transition metals and 4f rare earth systems. Using fs x-ray pulses from the BESSY II femtoslicing facility I will show how fs excitation of the electronic system modifies the spin-orbit interaction enabling ultrafast angular momentum transfer between spin, orbital and lattice degrees of freedom. I will also show first results demonstrating how the intense coherent fs x-ray pulses from the LCLS x-ray free electron laser allows us to access the nm length scale