European XFEL Science Seminar

Tuesday, 2nd April 2019, 13:00 ***(Light refreshments will be served at 12:30)***
Campus Schenefeld, XHQ, room E1.173

Steven Johnson

ETH Zurich / Paul Scherrer Institut

The Ultrafast Einstein-de Haas Effect

The original Einstein de Haas experiment of the early 20th century showed dramatically that the angular momentum of the electron spins responsible for ferromagnetism is the same “kind” of angular momentum that we know well from classical mechanics. In this talk I explore how the Einstein de Haas effect can manifest in the time domain on ultrafast time scales in response to ultrafast demagnetization of a 3d ferromagnet. In a thin film geometry, the transfer of angular momentum to the lattice is accomplished by a transient mechanical torque that launches a small but measurable transverse displacement wave into the film. I also describe an experiment using ultrafast x-ray diffraction performed at the LCLS free electron laser that observed these dynamics. Based on this we make a first estimate of the magnitude and time scale of angular momentum transfer to the lattice in the first few hundred femtoseconds after ultrafast demagnetization.

References:

C. Dornes et al. "The Ultrafast Einstein de Haas Effect." Nature (accepted, 2018), preprint at arXiv:1804.07159

Host: Robert Carley