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Magnetic soft X-ray microscopy: Towards imaging ultrafast spin dynamics on the nanoscale[1]

PETER FISCHER, CXRO/LBNL Berkeley CA

Modern magnetic microscopies are challenged with providing spatial resolution in the nanometer regime, a time resolution on a fs scale and elemental specificity to allow for studying multifunctional magnetic nanostructures and their ultrafast spin dynamics. Magnetic soft X-ray microscopy combines X-ray magnetic circular dichroism (X-MCD) as element specific magnetic contrast mechanism with high spatial and temporal resolution. Fresnel zone plates provide a spatial resolution down to currently <15nm [1] with current developments approaching the 10nm regime thus approaching fundamental magnetic length scales. Utilizing the inherent time structure of current synchrotron sources fast magnetization dynamics with 70ps time resolution, limited by the lengths of the electron bunches, can be performed with a stroboscopic pump-probe scheme. Soft x-ray microscopy at upcoming high brilliant fsec X-ray sources makes snapshot images of fsec spin dynamics feasible. In this talk I will present recent results on the study of the stochastical character in magnetization reversal and domain wall pinning [2] as well as on time resolved imaging of current induced resonant vortex core motion which allows to determine spin polarization of currents [3]

[1] D.-H. Kim, et al., J. Appl. Phys. 99, 08H303, (2006)
[2] M.-Y. Im et al, Adv. Mater 20 1750 (2008)
[3] S. Kasai et al. Phys Rev Lett (2008) accepted

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