

Magnetic Soft X-Ray Microscopy : A Path Towards Imaging Magnetism Down to Fundamental Length and Time Scales

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One of the scientific and technological challenges in nanomagnetism research is to image magnetism down to fundamental magnetic length and time scales with elemental sensitivity in advanced multicomponent materials. Magnetic soft X-ray microscopy is a unique analytical technique combining X-ray magnetic circular dichroism (X-MCD) as element specific magnetic contrast mechanism with high spatial and temporal resolution. Fresnel zone plates used as X-ray optical elements provide a spatial resolution down to currently 10nm thus approaching fundamental magnetic length scales such as magnetic exchange lengths. Images can be recorded in external magnetic fields giving access to study magnetization reversal phenomena on the nanoscale and its stochastic character with elemental sensitivity. Utilizing the inherent time structure of current synchrotron sources fast magnetization dynamics such as current induced wall and vortex dynamics in ferromagnetic elements can be performed with a stroboscopic pump-probe scheme with 70ps time resolution, limited by the lengths of the electron bunches.

With a spatial resolution approaching the <10nm regime, soft X-ray microscopy at next generation high brilliant fsec X-ray sources will make snapshot images of nanoscale ultrafast spin dynamics become feasible.



Dr. Peter Fischer received his PhD in Physics (Dr.rer.nat.) from the Technical University in Munich, Germany in 1993 and his habilitation from the University in Wuerzburg in 2000 based on his pioneering work on Magnetic Soft X-ray microscopy.

Since 2004 he is staff scientist at the Center for X-ray Optics within the Materials Science Division at Lawrence Berkeley National Laboratory in Berkeley CA. His current research program is focused on the use of polarized synchrotron radiation for the study of fundamental problems in nanomagnetism. He is involved in developing the scientific case for a next generation soft X-ray free electron laser at LBNL.

Dr. Fischer has published 135+ peer reviewed papers and has given 180+ invited presentations at national and international conferences and meetings.

For his achievements of “hitting the 10nm resolution milestone with soft X-ray microscopy” he was co-awarded with the Klaus Halbach Award at the Advanced Light Source in 2010.

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