CFEL SCIENCE

SEMINAR

30th September 2011 - 11:00 a.m.

building 28c (FLASH hall) - seminar room

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Imaging of Magnetic Domains using Linearly Polarised Light – Preparation for Single Shot Experiments

To date, there has been an extensive amount of work performed to image magnetic domains using coherent soft X-rays. A popular technique has been Fourier Transform Holography (FTH), which has the advantage of being simple to work with enabling a real space image to be realised without extensive data pre-processing, and is highly resistant to detector noise and incomplete spatial coherence. Disadvantages of FTH are however the fact that the resolution is limited to the dimensions of the reference wave source, and in the context of free electron laser experiments - the need for circularly polarised light which is not currently available without the inclusion of flux costly polarisers.

The difference between working with circularly and linearly polarised light, is that with circularly polarised light the diffraction pattern is a coherent superposition of the magnetic and non-magnetic (charge) scattering, whereas with linearly polarised light the superposition is incoherent. This means that with FTH, interference between the reference wave and the magnetic scatter no longer occurs, and performing an iterative reconstruction first requires that the charge scattering be subracted. The need to subtract the independently measured charge scattering provides no problem with synchrotron experiments as has been recently shown [1,2], but for a single shot experiment it is necessary to work with only an estimation of the charge scattering. We estimate the charge scattering by assuming it is slowly varying over the field of view, and subsequently show that it is then possible to reconstruct the magnetic domain pattern using standard iterative methods. This provides us with a promising method for imaging magnetic domains in an FEL experiment, including in a pump-probe setup.

1. Ashish Tripathi, Jyoti Mohanty, Sebastian H. Dietze, Oleg G. Shpyrko, Erik Shipton, Eric E. Fullerton, Sang Soo Kim, and a. I. McNulty, "Dichroic coherent diffractive imaging,"
Proceedings of the National Academy of Sciences of the United States of America 108, 13393-13398 (2011).

2. J. J. Turner, X. Huang, O. Krupin, K. A. Seu, D. Parks, S. Kevan, E. Lima, K. Kisslinger, I. McNulty, R. Gambino, S. Mangin, S. Roy, and P. Fischer, "X-Ray Diffraction Microscopy of Magnetic Structures,"
Physical Review Letters 107, 033904 (2011).

Host: Henry Chapman – CFEL Coherent Imaging Division