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Ultrasensitive Scanning Transmission X-ray Microscopy: Pushing the Limits of Time Resolution and Magnetic Sensitivity HENDRIK OHLDAG, SLAC - Natl Accelerator Lab — Understanding magnetic properties at ultrafast timescales is crucial for the development of new magnetic devices. Samples of interest are often thin film magnetic multilayers with thicknesses in the range of a few atomic layers. This fact alone presents a sensitivity challenge in STXM microscopy, which is more suited toward studying thicker samples. In addition the relevant time scale is of the order of 10 ps, which is well below the typical x-ray pulse length of 50 100 ps. The SSRL STXM is equipped with a single photon counting electronics that effectively allows using a double lock-in detection at 476MHz (the x-ray pulse frequency) and 1.28MHz (the synchrotron revelation frequency) to provide the required sensitivity. In the first year of operation the excellent spatial resolution, temporal stability and sensitivity of the detection electronics of this microscope has enabled researchers to acquire time resolved images of standing as well as traveling spin waves in a spin torque oscillator in real space as well as detect the real time spin accumulation in non magnetic Copper once a spin polarized current is injected into this material. The total magnetic moment is comparable to that of a single nanocube of magnetic Fe buried under a micron of non-magnetic material.

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