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**Ultrafast Spectroscopy on Solids at FLASH** DAVID BERNSTEIN, Stanford University, YVES ACREMANN, ANDREAS SCHERZ, SLAC, MARTIN BEYE, ALEXANDER FÖHLISCH, WILLIAM SCHLOTTER, DESY, TORBIN BEECK, FLORIAN SORGENFREI, ANNETTE PIETZSCH, WILFRIED WURTH, DESY, JOACHIM STÖHR, SLAC — X-ray/VUV free electron laser (FEL) facilities such as FLASH, LCLS, and the European X-FEL open the door to a wide variety of exciting experiments in x-ray physics. Due to the random stochastic processes governing FEL radiation and the difficulties in tuning an FEL, it has not been clear whether spectroscopy could be done using such sources. Here we demonstrate the feasibility of doing near edge x-ray absorption fine structure (NEXAFS) spectroscopy on solids. Samples consisting of LaMnO and Al films, respectively, were lithographically fabricated on thin silicon nitride membranes. Ultrafast femtosecond pulses of radiation from the FLASH FEL were dispersed by the monochromator grating at beamline PG2 and impinged upon the samples. Absorption was measured in transmission using a Ce:YAG crystal and imaged by an intensified CCD. The incident intensity was measured through a blank nitride membrane next to the sample. By tuning the FEL to the La N-edge ($\sim$ 102eV) and the Al L-edge ($\sim$ 72eV), respectively, we take an entire NEXAFS absorption spectrum in each shot. Spectra are calculated using many shots in order to reduce statistical uncertainties.

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