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Uncovering the Ultrafast Angular Momentum Transfer Channels on the Nanoscale in GdFeCo CATHERINE GRAVES, Stanford University, ALEX REID, Stanford Institute for Materials and Energy Science, BENNY WU, TIANHAN WANG, Stanford University, SANNE DE JONG, Stanford Institute for Materials and Energy Science, ILIE RADU, Radboud University Nijmegen, SASHA EPP, ROBERT HARTMANN, MPG-ASG Hamburg, ARATA TSUKAMOTO, Nihon University, Japan, RYAN COFFEE, MINA BIONTA, JOSHUA TURNER, WILLIAM SCHLOTTER, Linac Coherent Light Source, YVES ACREMANN, ETH Zürich, ALEXEY KIMEL, ANDREI KIRILYUK, Radboud University Nijmegen, JOACHIM STÖHR, Linac Coherent Light Source, THEO RASING, Radboud University Nijmegen, HERMANN DÜRR, ANDREAS SCHERZ, Stanford Institute for Materials and Energy Science — The ultrafast control of electron spins is of both fundamental scientific and technological interest. Recent experiments have shown that femtosecond laser excitation can act as a stimulus to switch the magnetization direction in ferrimagnetic GdFeCo, called all-optical switching. However, how angular momentum is transferred to result in a switched state remains unknown. To further understand this mechanism, we use 80fs x-ray pulses from LCLS to study how angular momentum transfer is triggered in GdFeCo by fs laser excitation using time-, element- and spatially-resolved x-ray resonant magnetic scattering. We present here the first-ever measurement of the fs magnetic response in GdFeCo with spatial resolution down to 10nm. Our results reveal drastically different behaviors on the nanoscale as compared to the bulk and provide insight into the angular momentum transfer channels.

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