

Abstract Submitted
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Exchange interaction reduction as a precursor to laser-induced demagnetization in ferromagnets¹ GUOPING ZHANG, YIHUA BAI, Indiana State University, THOMAS F. GEORGE, University of Missouri-St. Louis — Laser-induced femtosecond demagnetization in a ferromagnet presents an opportunity to develop all-optical ultrafast magnetic storage devices, but its underlying mechanism is under intense debate. The controversy has been on the first several hundred femtoseconds, where the spin moment is reduced sharply up to 50% or higher, but the optically accessible electrons are very few. This apparent contradiction is puzzling. Here we show that a small number of excited electrons is enough to trigger a strong band structure relaxation. In all of the three 3d ferromagnets investigated here, this band relaxation sharply reduces the exchange splitting and spin moment. For fcc Ni, for every electron excited, the spin moment can be reduced by $0.23 \mu_B$ or more. Our first-principles calculation, free of fitting parameters of any kind, finally explains the experimental findings and presents a paradigm for future experiments.

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