Abstract Submitted
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Laser-induced orbital and spin excitations in ferromagnets: Insights from a two-level system[1] GUOPING ZHANG, Department of Physics, Indiana State University, Terre Haute, Indiana 47809, YIHUA BAI, Center for Instruction, Research and Teaching, Indiana State University, Terre Haute, Indiana — A recent element-specific and time-resolved measurement in Fe/Gd multilayers showed the laser-induced orbital and spin excitations proceed in unison and the spin-orbit ratio is held constant during the demagnetization. Here a two-level model shows that these orbital and spin excitations originate from state population and state interference effect. For an addressed state, spin and orbital dynamics are solely from the state interference, where the spin and orbital momenta oscillate with the laser frequency and match the dipole moment exactly, an unambiguous test case for time-resolved magneto-optical Kerr effect. For an undressed state, the inference effect introduces a rapid beating in orbital momentum, which is observed in the first-principles calculation in fcc Ni. The state population change leads to a constant spin-orbit ratio, which explains the linear dependence between spin and orbital momentum changes within 2 ps upon the arrival of pump pulse in ferromagnetic iron.

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