

## Quantum Dynamics in Tailored Intense Fields

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### Laser induced inter-site spin transfer

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Laser pulses induce spin-selective charge flow that we show generates dramatic changes in the magnetic structure of materials, including a switching of magnetic order from anti-ferromagnetic (AFM) to transient ferromagnetic (FM) in multi-sub-lattice systems. The microscopic mechanism underpinning this ultra-fast switching of magnetic order is dominated by spin-selective charge transfer from one magnetic sub-lattice to another. As this spin modulation is purely optical in nature (i.e. not mediated indirectly via the spin-orbit interaction) this is one of the fastest means of manipulating spin by light. We further demonstrate this mechanism to be universally applicable to AFM, FM and ferri-magnets, in both multilayer and bulk geometry, and provide three rules that encapsulate early time magnetization dynamics of multi-sub-lattice systems.

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