

Filtering spins at optical-field-induced charge transfers: petahertz spin diode

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A superb manipulation of the optical-field-induced petahertz (PHz, 10^{15} Hz) charge processing driven by a strong few-cycle optical waveform enables an exploration of spin processing at the same speed. In a proposed model of the two-dimensional (2D) ferromagnetic (FM)-nonmagnetic (NM) heterostructure, net spins are found to be filtered down to the NM layer at the optical-field-induced charge transfers oscillating between FM and NM layers. A phase retardation is also found to be caused in the charge transfer by the spin-orbit coupling. This finding introduces a petahertz spin diode, broadening horizons of the spintronics up to the subfemtosecond time span.