Unveiling the Hidden Nematicity and Spin Subsystem in FeSe

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The anisotropic quasiparticle dynamics in FeSe single crystals have been studied by polarized pump-probe spectroscopy [1]. Two distinguishable relaxation components were unambiguously observed in transient reflectivity changes ($\Delta R/R$). The orientation-dependent fast component with the timescale of 0.1-1.5 ps associated with the electronic structure clearly shows two-fold symmetry, which further reveals the gap opening along k_y below the temperature of structure phase transition (T_s) and the electronic nematicity can persist up to 200 K. For the slow component with the timescale of 8-25 ps, it is assigned to the energy relaxation through spin sub-system and also shows a two-fold symmetry below T_s. However, this two-fold symmetry is dramatically weakened above Ts and surprisingly persists up to at least 200 K. Consequently, the high-temperature nematic fluctuations in FeSe may be driven by the order parameters which associated with both charge (orbital) and spin sub-systems.

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Reference

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