

Ultrafast decoupling of magnon-photon states in altermagnet α -MnTe

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Ultrafast modulation of hybrid light–matter states provides a powerful route toward dynamic control of terahertz (THz) excitations. Here we report time-resolved THz spectroscopy of magnon–photon coupled states in an altermagnetic semiconductor α -MnTe, hosting a magnon mode at approximately 0.85 THz [1]. In the presence of a metasurface, the magnon hybridizes with a photonic resonance, forming coupled magnon–photon states in the weak coupling regime. Upon ultrafast optical excitation above the band gap, photoinduced carriers lead to a rapid increase of the electrical conductivity, which modifies the resonance frequency and linewidth of the metasurface mode. This results in an ultrafast detuning between the photonic resonance and the magnon mode, effectively decoupling the hybridized states. Time-resolved measurements reveal pronounced changes in the magnon linewidth and amplitude on picosecond timescales, reflecting the transient modification of the coupling strength rather than direct optical excitation of the magnetic system. Our results demonstrate ultrafast, reversible decoupling of magnon–photon states in an altermagnetic semiconductor and establish α -MnTe as a platform for dynamic THz light–matter control.

References:

[1] J. Dzian et al, Phys. Rev. B 112, 024433 (2025)

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