

Multiple Wave Mixing in a Room Temperature Altermagnet

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Altermagnets present a new class of materials with magnetic crystal order and non-relativistic spin-splitting of the electronic bands. The extent to which altermagnetic order affects the electrical material properties remains an open question, leaving their technological potential unexplored. We report the discovery of a third-order nonlinear anomalous Hall effect in altermagnetic CrSb, which appears in leading order under ambient conditions. Theoretical analyses show that this nonlinear Hall response is induced by the nonlinear Hall conductivity of a Berry curvature quadrupole, which is characterized by all symmetries encoded in the altermagnetic g-wave order parameter. We utilize this nonlinear response of the Berry curvature quadrupole to realize a broadband multiple wave mixing device under ambient conditions. Our study establishes altermagnets as nonlinear electric materials and demonstrates their technological potential for high-frequency electronics, THz generation, and communication networks.