

SES19-2019-000210

Abstract for an Invited Paper
for the SES19 Meeting of
the American Physical Society

Ultrafast topological resonances in transition metal dichalcogenide monolayers

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We predict that a single cycle of a circularly polarized intense laser pulse populates the conduction band of the monolayer of transition metal dichalcogenides and induces ultrafast and strong valley polarization. This induced valley polarization is a result of ultrafast topological resonances, which occur when the topological (geometrical) phase and dynamic phase cancel out each other. The topological resonance, a nonlinear phenomenon independent of the electron spin, is manifested in materials with hexagonal lattice and broken inversion symmetry.