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Ultrafast reflectance of photoexcited Weyl and Dirac semimetals TaAs and ZrSiS CHRISTOPHER WEBER, BRYAN BERGGREN, Santa Clara University, KESHAV DANI, Okinawa Institute of Science and Technology, MAZHAR ALI, STUART PARKIN, IBM-Almaden Research Center, LESLIE SCHOOP, BETTINA LOTSCH, Max Planck Institute for Solid State Research, LINGXIAO ZHAO, GENFU CHEN, Beijing National Laboratory for Condensed Matter Physics, — We report ultrafast pump-probe and transient-grating (TG) measurements of the Weyl semimetal TaAs and the Dirac line-node semimetal ZrSiS, and contrast these results with prior measurements on the Dirac semimetal Cd_3As_2. After absorption of photons from the pump pulse, we monitor the samples' recovery to equilibrium by measuring the change in reflectance of a time-delayed probe pulse. For TaAs, the reflectance recovers in just 1.2 ps, significantly faster than the 3.1 ps measured in Cd_3As_2. This rapid recovery appears not to change when temperature is varied from 300 K to 8 K, when a magnetic field of order 0.3 T is applied, or when the excitation fluence is increased by a factor of 20. TG measurements allow us to assign the changes in reflectance to changes in either the dispersive (real) or absorptive (imaginary) parts of the index of refraction. Intriguingly, and in contrast to Cd_3As_2, the initial change in reflectance is caused by an abrupt reduction in the dispersive part, followed by a slower reduction in the absorptive part. For ZrSiS, the recovery after photoexcitation is even faster, at 0.3 ps. We will discuss the implications of these findings for carrier dynamics in topological semimetals.

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