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Ultrafast Photo-Carrier Dynamics and Coherent Phonon Excitations in Topological Dirac Semimetal Cd_3As_2[1] FEI SUN, QIONG WU, YANLING WU, YICHAO TIAN, YOUGUO SHI, JIMIN ZHAO, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences — Three dimensional (3D) topological Dirac semimetal has attracted growing research interest owing to its intriguing quantum properties such as high bulk carrier mobility and quantum spin Hall effects. However, so far, the ultrafast dynamics of a typical 3D topological Dirac semimetal, Cd_3As_2, as well as its coherent phonon has not been thoroughly investigated. Here we report the ultrafast dynamics of Cd_3As_2 by using femtosecond pump-probe spectroscopy. Two distinct relaxation processes was observed, with the lifetimes (at 5 K) of 2.4 ps and 18.6 ps, respectively. Variable temperature experiment from 5 K to 295 K also reveals signatures of phase transitions. Furthermore, coherent optical (8.1 meV) and acoustic (0.036 THz) phonon modes were generated and detected, respectively, with signatures of hybrid-excitation of the two modes.

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