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Breakdown of Three-dimensional Dirac Semimetal State in pressurized Cd_3As_2 LILING SUN, SHAN ZHANG, QI WU, Institute of Physics, CAS, China, LESLIE SCHOOP, MAZHAR ALI, Department of Chemistry, Princeton University, USA, YOUGUO SHI, Institute of Physics, Chinese Academy of Sciences, China, NI NI, Department of Physics and Astronomy, UCLA, USA, QUINN GIBSON, Department of Chemistry, Princeton University, USA, SHAN JIANG, Department of Physics and Astronomy, UCLA, USA, VLADIMIR SIDOROV, Institute for High Pressure Physics, RAS, Russia, XI DAI, ZHONG FANG, Institute of Physics, CAS, China, ROBERT J. CAVA, Department of Chemistry, Princeton University, USA, ZHONGXIAN ZHAO, Institute of Physics, CAS,China — Theory predicts that three-dimensional Dirac semimetals (3D-DSMs) can be turned into a variety of novel quantum phases by tuning control parameters to break either time reversal symmetry or inversion symmetry. Pressure is one such parameter, and can manipulate electronic and crystal structures without changing the chemistry. Here, we report the first observation of a pressure-induced breakdown of the 3D-DSM state in Cd_3As_2. *In-situ* synchrotron X-ray and single crystal resistance measurements find that Cd_3As_2 undergoes a structural phase transition from a metallic tetragonal phase to a semiconducting high pressure phase at 2.57 GPa; the phase transition breaks the semimetal state. Applying pressure around the phase transition, we observe unusual physical phenomena, including dramatic changes in mobility, Hall resistance and magnetoresistance in addition to the gap opening, which demonstrate the breakdown of the 3D-DSM state.

Liling Sun
Institute of Physics, Chinese Academy of Sciences

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