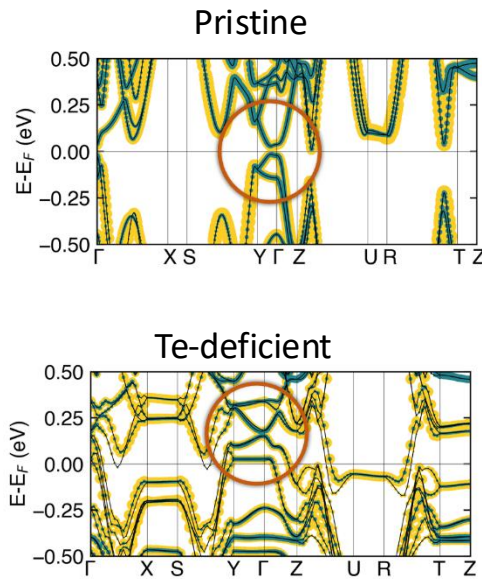
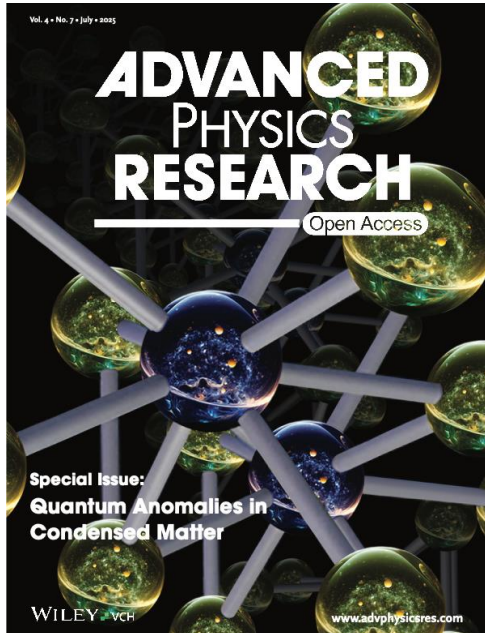


Rationalizing Transport Properties of ZrTe_5 and HfTe_5 via Te Deficiency: Towards Observation of Quantum Anomalies



Scientific Achievement

Electronic structure calculations demonstrate that Te vacancies in ZrTe_5 and HfTe_5 , which proliferate or are absent depending on synthesis method, rationalize conflicting spectroscopic and transport measurement without eliminating the Dirac physics of these materials.

Significance and Impact

These calculations resolve unanswered questions about sample-dependent variations in the low temperature transport of the Dirac materials ZrTe_5 and HfTe_5 , demonstrating the power of condensed matter platforms to elucidate outstanding questions in cosmological physics, such as quantum anomalies.

Research Details

- The pristine materials are insulating at low temperature, but trivial in-gap states localized at Te vacancies make Te-deficient samples metallic.
- The Dirac point is maintained irrespective of Te content, indicating the Dirac physics potentially driving a chiral anomaly is robust to variations in sample growth method.

Figure: (left) Journal cover depicting galaxies hidden in the atoms of HfTe_5 (right) calculated band structures of HfTe_5 with and without Te vacancies, rationalizing insulating and metallic low temperature transport of pristine and Te-deficient HfTe_5

Work was performed, in part, at the Center for Integrated Nanotechnologies.

Peterson, E. A.; Lane, C.; Zhu, J. Te Vacancy-driven Anomalous Transport in ZrTe_5 and HfTe_5 . *Advanced Physics Research*. 2024.