Revealing Polaronic Effects and Their Impact on Transport in Titanium Trisulfide through UV-ARPES

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The quasi-one-dimensional semiconductor titanium trisulfide (TiS_3) exhibits a metal–insulator transition accompanied by pronounced transport anomalies, whose microscopic origin remains under debate [1,2,3]. In this work, I present a detailed ARPES investigation of its electronic structure, focusing on the role of electron–phonon interaction. High-resolution UV-ARPES measurements reveal clear signatures of strong coupling, including replica bands and spectral weight redistribution characteristic of Holstein polarons formed via interaction with an infrared-active A_u phonon mode.

By systematically varying temperature and carrier concentration, we track the evolution of these polaronic features and observe a pronounced renormalization of the quasiparticle dispersion and linewidth. These spectral changes correlate directly with anomalies in the resistivity, providing evidence for a crossover between distinct charge transport regimes governed by many-body interactions.

Our results establish a direct link between microscopic many-body interactions and macroscopic transport properties in TiS_3, highlighting the power of ARPES as a tool for understanding complex quantum materials.

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[2] E. Gorlova *et al.*, Nonlinear transport and anisotropy in quasi-one-dimensional TiS_3, *Physica B* **460**, 11–15 (2015).

[3] A. Randle *et al.*, Gate-Controlled Metal–Insulator Transition in TiS_3, *ACS Nano* **13**, 803–811 (2019).