Weyl points, trivial surface states and particle-hole compensation in WP2

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A possible connection between extremely large magneto-resistance and the presence of Weyl points has garnered much attention in the study of topological semimetals. Exploration of these concepts in transition metal phosphide WP_2 has been complicated by conflicting experimental reports. Here we combine angle-resolved photoemission spectroscopy (ARPES) and density functional theory (DFT) calculations to disentangle surface and bulk contributions to the ARPES intensity, the superposition of which has plagued the determination of the electronic structure in WP_2. Our results show that while the hole- and electron-like Fermi surface sheets originating from surface states have different areas, the bulk-band structure of WP_2 is electron-hole-compensated in agreement with DFT. Furthermore, the detailed band structure is compatible with the presence of at least 4 temperature independent Weyl points, confirming the topological nature of WP_2 and its stability against lattice distortions [1].

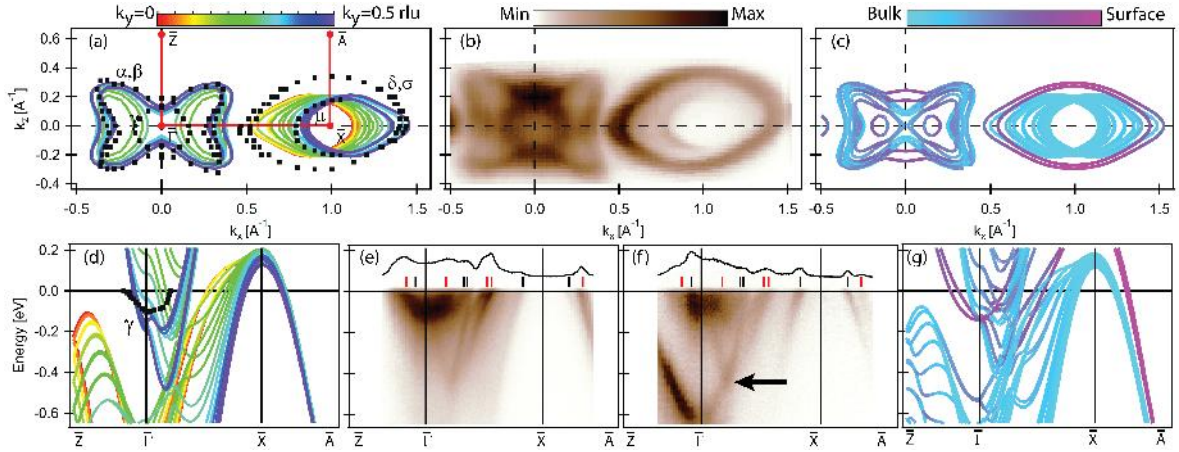

Figure. (a) Bulk DFT calculations at E_F in the k_y-k_z plane. Black squares indicate the k_F*s* extracted from the MDC peak position of data in (b). (b) ARPES intensity maps at E_F in the k_x-k_z plane at hv = 50 eV. (c) DFT band structure in the k_x-k_z plane of a WP_2-slab of 18 W-planes. (d) Bulk band structure along high symmetry lines [red path in panel (a)]. (e), (f) ARPES intensity maps along high symmetry lines for *p*- and *s*-polarized light, respectively. MDCs at the E_F are shown in the inset. Red (Black) vertical lines identify surface (bulk) peaks in the MDCs. Black arrow indicates the position of the Weyl point. (g) Slab DFT band structure along high symmetry lines.

References

[1] E. Razzoli, B. Zwartsenberg, M. Michiardi, F. Boschini, R. P. Day, I. S. Elfimov, J. D. Denlinger, V. Süß, C. Felser, A. Damascelli, "Stable Weyl points, trivial surface states and particle-hole compensation in WP_2", arXiv:1801.03956 (2018).