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Soft-X-Ray ARPES View of Three-Dimensional Electronic Structure

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ARPES experiments in the soft-X-ray energy range bring advantages of free-electron final states, simplified matrix elements and increasing photoelectron escape depth. The latter, along with enhancement of the bulk sensitivity, improves intrinsic resolution in surface-perpendicular momentum. This enables investigations of electronic structure under reliable control of the three-dimensional (3D) momentum k.

Soft-X-ray ARPES experiments at SLS are performed at the ADRESS beamline operating in a photon energy range from 300 to 1600 eV. High photon flux topping up 10^13 photons/s/0.01%BW at 1 keV has allowed us to break through the notorious problem of small valence band crossection in the soft-X-ray range.

Our pilot experiments included determination of 3D Fermi surface (FS) of VSe2, with its warping giving rise to 3D charge density waves (CDWs), exciton mediated CDWs in TiSe2, alternating shapes of the FS in 3D pnictides, hybridization effects in heavy-fermion systems, and FS of buried layers in LaNiO3/LaAlO3 hererostructures. Our results demonstrate an immense potential of soft-X-ray ARPES to deliver a clear view of electronic structure with resolution in 3D k-space.

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Multiple Order Parameter Systems

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