Angle-resolved Photoemission spectroscopy of $ZrTe_3$ and 2H-$NbSe_2$

$ZrTe_3$ and 2H-$NbSe_2$ are charge-density-wave(CDW) materials which remain metallic in the CDW state. While $ZrTe_3$ is known to possess Fermi surface (FS) sheets with differing dimensionality (quasi-1D and 3D), 2H-$NbSe_2$ has a quasi-2D or layered structure. Interestingly, both the materials show low-Tc superconductivity.

Angle-resolved photoemission spectroscopy is used to study the electronic structure of $ZrTe_3$, from T = 300 K down to 6 K (across T_{CDW} = 63K), with the aim of studying charge-density-wave (CDW) fluctuation effects in a metallic CDW compound having Fermi surface (FS) sheets with differing dimensionality. While spectra on the 3-D FS show typical Fermi-Dirac function-like *T*-dependence, those along the quasi 1-D FS show formation of a pseudogap, starting at a much higher temperature than T_{CDW}. Simultaneously, a van-Hove singularity consisting of the quasi 1D FS intersecting the 3D FS shows a sharp quasiparticle peak which we associate with increasing coherence. The results show the role of CDW fluctuations on the spectral function, and relation to the dimensionality of the states, in a metallic CDW system.

The Charge-density-wave(CDW) and superconductivity which co-exist in 2*H*-$NbSe_2$(T_{CDW} ~ 33 K, T_c = 7.2 K), are investigated using angle-resolved photoemission spectroscopy as a function of temperature. Across T_{CDW}, energy and momentum(*k*) distribution curves show changes associated with the primary and secondary CDW vectors. The CDW order occurs at specific *k*-points on FSs in the 2-D Brillouin zone with spectral weight suppression, but no gap formation. In an earlier study, the momentum dependence of the superconducting gap showed FS sheet-dependent superconductivity in this low-transition temperature system. We extend our study to investigate the interplay of CDW order and superconductivity as a function of momentum on the Nb derived FS sheets. We find evidence for a suprising correlation : the specific momenta associated with the CDW exhibit maximal superconductivity. The results further show that at the same momenta, the Fermi velocities are the lowest and the electron-phonon coupling is the highest.