Charge Density Wave Gap Spectroscopy in Quasi-one-dimensional Compounds

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Abstract. One-dimensional conductors, unstable under electronic fluctuations, undergo a lattice modulation of wavevector $q = 2k_F$ (where k_F is the conduction band Fermi wavevector) associated with the formation of a charge density wave (CDW) of the same periodicity. One of the most important parameter of this condensed state is the energy gap opened in the single-particule excitation spectrum below the Peierls transition temperature. In real quasi-one-dimensional with transverse couplings, the gapping may be incomplete, with parts of the Fermi surface remaining metallic. A case of point is the Peierls system $NbSe_3$ which at temperatures below the formation of two independant CDWs remains metallic.

I will present gap determinations in this compound using the method of interlayer tunneling. This technique is based on the fact that transport across layers in many highly anisotropic materials occurs due to the tunneling between elementary conducting layers separated by atomically thin insulating barriers. This method provides the possibility of accessing electronic condensed states formed at elementary conducting layers. The technique was initially used for layered high Tc superconductors, and later has been extended to studies of CDW states in $NbSe_3$. Experimentally, the transport across such a layer is studied with mesa structures with micron scale lateral sizes. Small mesa sizes provide phase coherence and conditions to avoid self-heating effects.

The interband transitions across the two CDW gaps will be compared with those determined by other techniques such as optics, photoemission, STM, break-junction technique, point spectroscopy and tunnel spectroscopy.

The high capability of interlayer tunneling spectroscopy for studies of intragap excitations assigned to CDW amplitude [1] and phase excitations [2] will also be demonstrated.

REFERENCES

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2. Yu. I. Latyshev, P. Monceau, S. Brazovskii, A. P. Orlov, and T. Fournier, *Phys. Rev. Lett.* **96**, 116402 (2006).

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