Transport and spectroscopic properties of the quasi-1D compound $(NbSe_4)_3I$

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Abstract

The one-dimensional (1D) electronic systems are a fascinating subject of scientific research because, when confined to one dimension, itinerant electrons undergo transitions to different types of collective ground states. A common example of such transition is Pierls transition from a high-temperature metallic state to a low-temperature charge density wave (CDW) semiconducting state, due to strong electron-phonon coupling.

Halogenated transition metal tetrachalcogenides of the $(MX_4)_nY$ family ($M = Nb, Ta; X = S, Se; Y = I, Br$) provide a typical example of 1D compounds that can potentially undergo CDW transition and exhibit nonlinear transport properties. To explore those properties we can employ a range of different experimental techniques. Among them, dielectric spectroscopy is an appropriate technique for investigation of dynamics of the phase degree freedom in CDW systems. However, to have a complete understanding of the dynamical properties of the material it is important to obtain the information from several complementary experiments.

In this seminar, I will present transport and spectroscopic (pump-probe and dielectric) studies on the halogenated niobium tetraselenide, $(NbSe_4)_3I$. It is the only representative of 1D halogenated transition metal tetrachalcogenides which does not undergo typical Pierls transition into the CDW ground state. Instead, a structural ferrodisortive transition without a noticeable appearance of the superstructure has been observed. In addition to the properties of the equilibrium state, I will also present some unpublished results of photoinduced metastable states in this compound.

Keywords:
charge density wave, 1D compounds, dielectric spectroscopy, pump-probe spectroscopy, conductivity, phase transition

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