Poster-1-17

Electrical transport study near a zero-Kelvin metal-insulator transition of bulk nickelates Pr1-xLaxNiO3

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The discovery of superconducting phases in different types of nickelates, including infinite-layer nickelates [1], quintuple-layer nickelates [2], and pressure-induced bulk nickelates [3], has sparked significant interest and motivated further exploration for new nickelate superconductors. Superconductivity in cuprates, Cu-based analogue of nickelates, is strongly influenced by magnetic fluctuations associated with an antiferromagnetic quantum phase transition [4]. Understanding the mechanism of Cooper pairing in cuprates, which cannot be fully explained by the conventional BCS theory, requires investigating anomalous phenomena connected to magnetic quantum phase transition, which could also play a crucial role in nickelate superconductors. The compound RNiO3 (where R represents rare earth elements) exhibits diverse ground states, such as metallic paramagnet and insulating antiferromagnet, depending on the specific rare earth element [5]. By applying pressure to PrNiO3, a compound located near a zero-Kelvin metal-insulator transition (MIT), it is possible to tune the insulating antiferromagnetic (I-AF) ground state into a metallic paramagnetic (M-PM) state at a critical pressure of Pc $\sim$ 1 GPa [6]. Near Pc, temperature-dependent electrical resistivity, measured above 5 K, was fitted with a temperature exponent of 4/3, which may be related to the antiferromagnetic fluctuation associated with the critical point. The phase transition from I-AF to M-PM of PrNiO3 can also be achieved by La-doping, which leads to a structural transition from a monoclinic structure (P21/n) to an orthorhombic structure (Pbmn) [5]. In this presentation, we will revisit the zero-Kelvin MIT of PrNiO3 via La-doping. We have successfully synthesized a series of Pr1-xLaxNiO3 polycrystals using high-pressure synthesis and measured the electrical resistivity of the samples down to $T = 0.5$ K in order to investigate the anomalous phenomena associated with quantum fluctuations near the zero-Kelvin MIT.

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