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Quantum phase superconductor-insulator transition in multi-phase Li_xMoS_2 nanosheets

Intercalation compounds of molybdenum disulfide (MoS_2) with alkali metals and alkaline earth metals are known to superconduct below a critical temperature of 3~7 K [1]. These compounds are often sub-stoichiometric and structurally disordered with multiple polymorphs present in a single crystal. Here we report observation of superconductor-insulator quantum phase [2, 3] transition in mechanically exfoliated nanosheets of Li_xMoS_2 that predominantly consists of a disordered metallic T/T' polymorphs. We show that the superconductor-insulator transition can be induced either by external magnetic fields or by de-intercalation of lithium. Scaling analysis reveals that superconductor-insulator transition is driven by structural disorder associated with the presence of multiple polymorphs in a single crystal and local fluctuations in the doping densities. Instability of the critical magnetic field at low temperatures accompanied by divergence of dynamical critical exponent can be attributed to the emergence of quantum Griffiths singularity [4, 5].

References

[1] J.A. Woollam and R.B. Somoano, Materials Science and Engineering, 31 (1977) 289
[2] A.M. Goldman and N. Marković, Physics Today, 251 (1998) 39
[3] Y.-H. Lin, *et al*., Physica C: Superconductivity and its Applications,. 514 (2015) 130
[4] B. M. McCoy and T. T. Wu, Phys. Rev. 176 (1968) 631; R. B. Griffiths, Phys. Rev. Lett. 23 (1969) 17
[5] Y. Xing, et al., Science 350 (2015), 542