Emergent Superconductivity in Low Dimensions

Low-dimensional systems provide the opportunity to explore the relationship between electronic correlations, dimensionality, inhomogeneity, and superconductivity. In this work, single crystals of the quasi-one-dimensional $\text{Na}_{2-\delta}\text{Mo}_6\text{Se}_6$ are studied, composed of MoSe filaments weakly coupled by Na atoms and subject to intrinsic disorder ($>0$). $\text{Na}_{2-\delta}\text{Mo}_6\text{Se}_6$ is demonstrated to display strong electronic correlations in its normal state, whereas a superconducting ground state emerges from Anderson localized electrons. Two novel behaviors of the superconducting state are observed: first, a disorder-induced enhancement of the superconducting transition temperature; second, a reentrant phase coherence with increasing temperature, magnetic field, and current. The intrinsic properties of $\text{Na}_{2-\delta}\text{Mo}_6\text{Se}_6$ are analyzed to offer a thorough understanding of these phenomena. The emergence of superconductivity in such low-dimensional systems provides a fruitful playground to explore electronic order and correlations.

Date: 27 January 2017
Time: 2PM
Venue: Conference Room, Level 2, SPMS Research & Graduate Studies Office
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