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Purely electronic transport and many-body localization in disordered superconductors

Certain strongly disordered superconducting films, when driven insulating by reducing film thickness or by a magnetic field, are believed to maintain strong pairing of electrons into localized Cooper pairs. Several experimental findings hint that this 'dirty boson' scenario is realized in indium-oxide, or titanium-nitride films, for example. The ensuing insulators have a variety of very peculiar properties: they exhibit a simply activated resistance, which moreover is of purely electronic nature, both of which are a puzzle to understand in disordered insulators.

A possible explanation arises from the analysis of the spectral properties of dirty bosons across the phase transition, suggesting that a possible "localization in Fock space" may take place in such disordered many body system. Experimental implications of such a scenario will be discussed.



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