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Nature of the superconductor-insulator transition in disordered thin films YONATAN DUBI, Physics Department, University of California-San Diego, YIGAL MEIR, YSHAI AVISHAI, Department of Physics and The Ilse Katz Center for Meso- and Nano-Scale Science and Technology, Ben Gurion University, Beer Sheva 84105, Israel — Highly disordered superconducting (SC) thin films undergo a magnetic-field (B) driven superconductor-insulator transition (SIT) whose detailed nature is still not completely understood. Starting from a microscopic description, we analyze this SIT in disordered thin films, and demonstrate that disorder leads to the formation of islands where SC order is rather high. For weak disorder, increasing B eventually results in the vanishing of the SC order parameter, implying an insulating state. At higher disorder, however, increasing B suppresses correlations between phases of the SC order parameter in different islands, giving rise to a novel kind of SIT. One of the remarkable predictions of this study is that in the latter regime, there are still SC islands in the sample even on the insulating side. This outcome, which is consistent with pertinent experiments, explains the recently observed huge magneto-resistance peak in disordered thin films. It may also be relevant in attempts to explain the occurrence of pseudo-gap in under-doped high-Tc superconductors, which have recently been found to be intrinsically disordered.

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