

Transport through disordered superconducting thin films

Yoni Dubi, Yigal Meir and Yshai Avishai

Physics Department, Ben Gurion University, Beer Sheva 84105, ISRAEL

Superconductor-insulator transition has been observed in thin films as a function of thickness, temperature or magnetic field. Such films also exhibit nonmonotonic magnetoresistance in the insulating regime, over several orders of magnitude. Here we demonstrate the formation of superconducting islands in the films due to the interplay of interaction and disorder. Using a newly developed method that allows the study of thermal fluctuations beyond the Bogoiubov - de Gennes equations, we show that disorder may change the nature of transition to become dominated by the loss of phase-rigidity between the sample edges, while superconducting correlation may still exist in the sample. The persistence of the superconducting islands in the insulating phase also explains the non-monotonic magnetoresistance and explain several other features seen in experiment.