

# Experimental investigations on disordered superconductors

Pratap Raychaudhuri

Department of Condensed Matter Physics and Materials Science  
Tata Institute of Fundamental Research, Mumbai

## Abstract

The Bardeen-Cooper-Schrieffer (BCS) theory formulated in the late 50's was remarkably successful in explaining properties in conventional superconductors. However, it has now been realized that when strong disorder in the form of crystalline defects or impurities are introduced, the same materials can behave in a completely different way, and give rise to novel electronic states, not predicted by the BCS theory. In this talk, I will describe our experiments on the strongly disordered superconductor, NbN, performed using a combination of magnetotransport, low temperature scanning tunneling microscopy and low and high-frequency electrodynamic measurements. I will show how several novel phenomena, such as the formation of a pseudogapped state above  $T_c$ , the observation of a Higgs mode, and the emergence of a novel insulating state related to superconductivity, emerge in the presence of strong disorder. I will also highlight some of the toys that we had to build as part of our quest.