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Effects of magnetic impurities on the Cooper Pair Insulator state¹

XUE ZHANG, JAMES JOY, Physics Department, Brown University, J.M. XU, Physics Department, Brown University; School of Engineering, Brown University, JAMES VALLES, Physics Department, Brown University — Superconductivity can be destroyed by adding magnetic impurities that produce time-reversal symmetry breaking electron scattering. In contrast to non-magnetic impurities, a tiny concentration of magnetic impurities can reduce the superconducting gap significantly. In our lab, we are investigating the Cooper pair insulator state that forms at the superconductor to insulator transition in metal films deposited onto nanostructured substrates. This Bose insulator state exhibits activated transport and a giant magnetoresistance peak similar to ones observed in other thin film systems. We are investigating how this novel insulating state responds to the addition of magnetic impurities. One of the goals is to gain insights into the microscopic origin of the transport activation energy. In this talk, I will present our latest results on how the transport properties of the Cooper pair insulator phase have drastically changed with addition of magnetic impurities.

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