Thermal Measurements at the SIT

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The superconductor-insulator transition (SIT) is a prototype of a quantum phase transition which is very versatile experimentally: varying a non-thermal tuning parameter such as disorder, thickness, composition, magnetic field or gate-voltage causes the system to switch from a superconductor to an insulator at zero temperature.

Unlike their classic counterparts, quantum phase transitions are governed by quantum fluctuations (QF) rather than thermal fluctuations. In a seminal paper Yigal and coworkers showed that this transition is governed by "electronic granularity" that induces these QF. The direct experimental study of such fluctuations close to the SIT is rather challenging. So far research has mainly concentrated on dc resistivity based measurements such as transport and magnetoresistance and on global and local tunneling spectroscopy. These provide only limited information on the critical behavior through the transition.

In my talk I will describe thermal (specific heat and Nernst effect) experiments designed to measure direct signatures of quantum fluctuations and critical behavior close to the SIT. I will discuss the significance of the results and their contribution to understanding the electronic processes in the vicinity of the quantum phase transition.