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A three-junction single electron transistor as a diffusive, high-speed thermometer: Experiment and simulation LOREN SWENSON, D.K. WOOD, A.N. CLELAND, University of California, Santa Barbara, PHYSICS TEAM — Nanoscale calorimetry promises unprecedented sensitivity and temporal resolution for energy measurements in mesoscopic systems. As the size scale and temperature of a calorimeter are reduced, the heat capacity and equilibration time decrease rapidly. Achieving the lowest temperatures at the smallest size scales therefore requires thermometric sensors that can be operated with large measurement bandwidths (> 1 MHz), at low temperatures (< 1 K), and that minimally perturb the calorimeter itself. We have fabricated a unique, three junction single-electron transistor that allows diffusive thermometric sensing of a nanoscale calorimeter, with minimal power dissipation in the calorimeter volume. In this talk, we will describe the experiment, and our development of a Monte Carlo method to simulate the experimental device. Design optimization, sensitivity and practical implementation considerations will be discussed.

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