A Flux Noise Thermometer Optimized for Use at Ultralow Temperatures

A. Fleischmann, A. Reiser, D. Rothfuß, and C. Enss

Kirchhoff-Institut für Physik, Universität Heidelberg, Im Neuenheimer Feld 227, D-69120 Heidelberg, Germany

The determination of the temperature below 1 mK is still a great experimental challenge. We have developed a SQUID-based flux noise thermometer and optimized this device for use at ultralow temperatures. As a noise source we have chosen a piece of cold-worked high purity copper with a resisitivity that corresponds to a bandwidth of the noise thermometer of about 100 Hz due to self shielding effects. The flux noise caused by the thermal motion of the electrons in the copper is picked up by a DC SQUID via a small superconducting flux transformer. In order to supress the amplifier noise we used two independent DC SQUIDs simultaniously and cross-correlated their outputs. In this way we obtained a reduction of the ampifier noise of more than one order of magnitude. This new technique covers almost five orders of magnitude in temperature including ultralow temperatures which were accessible only by Pt NMR so far. We present the experimental technique and show data obtain at the cold stage of nuclear demagnetisation cryostat between 45 μK and 0.8 K.

Section: TC - Techniques

Keywords: noise thermometry, cross correlation technique, SQUID