Challenges and Advances of Practical Primary Thermometers for Very Low Temperature

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The determination of temperature is a challenging task at very low temperatures. With only a provisional temperature scale in place for temperatures below 650 mK individual labs need practical primary thermometers to establish the temperature and to calibrate secondary thermometers. Two concepts have evolved as practical primary thermometers, Coulomb Blockade Thermometers (CPTs) and SQUID based current noise thermometers. In recent years CBTs have significantly advanced the lowest temperatures of operation and appear as the only means today to determine electronic temperature of micro- or nanostructures. A complimentary strength of current noise thermometers is their robustness against self-heating allowing them even to reach into the low microkelvin range. In the talk the current state of such primary thermometers will be reviewed and possible further developments will be discussed.