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**Johnson Noise Thermometry in the range 505 K to 933 K** WESTON TEW, JOHN LABENSKI[1], SAE WOO NAM, SAMUEL BENZ, PAUL DRESSELHAUS, NIST, Boulder CO, JOHN MARTINIS, UC Santa Barbara —
The International Temperature Scale of 1990 (ITS-90) is an artifact-based temperature scale, $T_{90}$, designed to approximate thermodynamic temperature $T$. The thermodynamic errors of the ITS-90, characterized as the value of $T - T_{90}$, only recently have been quantified by primary thermodynamic methods. Johnson Noise Thermometry (JNT) is a primary method which can be applied over wide temperature ranges, and NIST is currently using JNT to determine $T - T_{90}$ in the range 505 K to 933 K, overlapping both acoustic gas-based and radiation-based thermometry. Advances in digital electronics have now made the computationally intensive processing required for JNT viable using noise voltage correlation in the frequency domain. We have also optimized the design of the 5-wire JNT temperature probes to minimize electromagnetic interference and transmission line effects. Statistical uncertainties under 50 $\mu$K/K are achievable using relatively modest bandwidths of $\sim$100 kHz. The NIST JNT system will provide critical data for $T - T_{90}$ linking together the highly accurate acoustic gas-based data at lower temperatures with the higher-temperature radiation-based data, forming the basis for a new International Temperature Scale with greatly improved thermodynamic accuracy.

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