

Primary Acoustic Thermometry from 4 K to 300 K

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The National Metrology Institutes of France (BNM-INM) and the United States (NIST) are cooperating to develop an acoustic thermometer to operate in the range 4 K to 300 K. We will use an almost spherical, helium-filled cavity in a copper shell as both an acoustic and a microwave resonator. When extrapolated to zero pressure, the ratio of the resonance frequencies will accurately determine the Kelvin thermodynamic temperature T . This program will measure $(T - T_{90})$, where T_{90} is the temperature measured on ITS-90, the International Temperature Scale of 1990. The results will lead to wider acceptance of acoustic thermometry and may contribute to a successor to ITS-90. It is likely that the technologies developed will provide a useful alternative to the helium-filled, constant-volume, interpolating gas thermometer that defines ITS-90 in the range $5 \text{ K} < T < 24.6 \text{ K}$.