

FREQUENCY STABILITY OF 1×10^{-13} IN A COMPENSATED
SAPPHIRE OSCILLATOR OPERATING ABOVE 77 K

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Abstract

We report on tests of a compensated sapphire oscillator (CSO) which shows frequency-stable operation at temperatures above 77 K. The frequency stability for this oscillator shows an apparent flicker floor of 7.5×10^{-14} for measuring times between 3 and 10 seconds, and stability better than 2×10^{-13} for all measuring times between 1 and 100 seconds. These values are approximately the same as for the very best available quartz oscillators. Previously, high stability in sapphire oscillators had only been obtained with liquid helium cooling. Recent improvements include a more careful analysis of the ac frequency-lock "Pound" circuitry that now enables the oscillator to reliably attain a stability 6 million times better than its fractional resonator linewidth. Measurements to date have been made with a resonator quality factor $Q \approx 2 \times 10^6$. Frequency stability of 2×10^{-14} is projected for a resonator Q of 10^7 , a value about one third of the intrinsic sapphire Q at this temperature.

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