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^{87}Sr 1D Optical Lattice Clock With a 124 K Silicon Cavity: Full Systematic Evaluation and Record Precision TOBIAS BOTHWELL, DHRUV KEDAR, ERIC OELKER, COLIN KENNEDY, JOHN ROBINSON, SARAH BROMLEY, ROSS HUTSON, LINDSAY SONDERHOUSE, AKIHISA GOBAN, WILLIAM MILNER, CHRISTIAN SANNER, JUN YE, JILA, NIST, and University of Colorado Boulder — We report on the full systematic evaluation of the JILA Sr1 optical lattice clock using a laser stabilized to a 124 K silicon cavity. This evaluation resulted in a factor of 10 improvement over our previous evaluation of JILA Sr1 for the systematic uncertainty [1]. After the systematic evaluation of the JILA Sr2 clock at 2.1×10^{-18} [2], it is now operating in a 3D lattice configuration. We perform an extensive comparison between JILA Sr1 and Sr2 clocks and determine independent clock stability of 4.8×10^{-17} at 1 s. With synchronous clock operation we achieve stability of 3.5×10^{-17} at 1 s and a precision of 6×10^{-19} in 1 hour of measurement. The state-of-the-art precision and accuracy of this clock enables measurements for wide-ranging applications, from searches for dark matter to relativistic geodesy.
[1] Bloom, B. J., et al. "An optical lattice clock with accuracy and stability at the 10^{-18} level." Nature 506.7486 (2014): 71. [2] Nicholson, T. L., et al. "Systematic evaluation of an atomic clock at 2×10^{-18} total uncertainty." Nature communications 6 (2015): 6896.

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