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New performance for optical atomic clocks with cryogenic silicon cavities

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A high performance optical local oscillator is essential for advancing the stability of an optical clock, which is key to realize optical lattice clocks with uncertainty at the 19th digit. To address this challenge, we present advances in cryogenic optical cavities based on crystalline silicon, together with enhanced precision measurement techniques utilizing our 1D and 3D strontium clocks. Leveraging the silicon cavities improved frequency stability and predictability, an all-optical time scale has been realized, surpassing the current state-of-the-art time scales.