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Abstract for an Invited Paper
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Quantum-logic clocks for fundamental physics and geodesy[1]

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We have compared the rates of two quantum-logic clocks based on the optical $^1S_0$-$^3P_0$ transition in Al^+. The performance of the newer clock is unmatched, and despite many differences, their rates agree to $1.8 \pm 0.7 \times 10^{-17}$, within the accuracy limit of the older clock. The newer clock has an accuracy of 8.6×10^{-18} and stability near $10^{-15}(\tau/s)^{-1/2}$. Quantum-correlation spectroscopy yields an improved measurement stability of $3.7 \times 10^{-16}(\tau/s)^{-1/2}$. This technique also allows Q-factors beyond 6×10^{15} to be seen. This is the highest observed Q-factor in physics. The talk will discuss the basic operation of quantum-logic clocks based on Al^+, together with recent results that include a first geo-potential difference measurement, and constraints on the temporal variation of the fine-structure constant. Potential uses of entangled states in such clocks are also explored.

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