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Search for Temporal Variation of Fundamental Constants With Hg+ and Al+ Optical Clocks¹

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We measure the ratio of aluminum and mercury single-ion optical clock frequencies with a fractional uncertainty of 5.2×10^{-17} , comprising a statistical measurement uncertainty of 4.3×10^{-17} , and systematic uncertainties of 1.9×10^{-17} and 2.3×10^{-17} in the mercury and aluminum frequency standards, respectively. This frequency ratio is the best known physical constant that is not a simple integer. Repeated measurements during the past year yield a preliminary constraint on the temporal variation of the fine-structure constant of $\dot{\alpha}/\alpha = (-1.6 \pm 2.4) \times 10^{-17}/\text{year}$.

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