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Vibrational molecular lattice clock for fundamental physics
KON LEUNG, CHIH-HSI LEE, STANIMIR KONDOV, TANYA ZELEVINSKY, Columbia University — A molecular clock operating on rovibrational transitions is a promising instrument in the search for variations of the electron-to-proton mass ratio, presence of gravity-like forces at the nanometer-scale, and QED corrections to long-range interatomic interactions. I report the realization of a lattice clock with ultracold diatomic strontium, enabled by state-insensitive trapping of electronic ground-state molecules in an optical lattice tuned close to a narrow vibronic resonance belonging to the potential correlating to the atomic spin-forbidden intercombination line. At this magic wavelength, we observe more than a thousand-fold improvement in light-molecule coherence, achieving a Q factor of almost 10^{12}. I also discuss the ongoing systematic evaluation and conclude with an outlook for high-precision measurements with the molecular clock.

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