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Entangling the lattice clock: Towards Heisenberg-limited timekeeping JONATHAN D. WEINSTEIN, KYLE BELOY, ANDREI DEREVIANKO, Department of Physics, University of Nevada, Reno NV 89557 — We present a scheme for entangling the atoms of an optical lattice to reduce the quantum projection noise of a clock measurement. The divalent clock atoms are held in a lattice at a "magic" wavelength that does not perturb the clock frequency – to maintain clock accuracy – while an open-shell $J = 1/2$ "head" atom is coherently transported between lattice sites via the lattice polarization. This polarization- dependent "Archimedes' screw" transport at magic wavelength takes advantage of the vanishing vector polarizability of the scalar, $J = 0$, clock states of bosonic isotopes of divalent atoms. The on-site interactions between the clock atoms and the head atom are used to engineer entanglement and for clock readout.

Andrei Derevianko
University of Nevada

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