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Imaging optical frequencies with 100 μHz precision and 1.1 μm resolution ROSS B. HUTSON, G. EDWARD MARTI, AKIHISA GOBAN, SARA L. CAMPBELL, JILA, NIST and University of Colorado Boulder, NICOLA POLI, Dipartimento di Fisica e Astronomia and LENS - Università di Firenze, INFN - Sezione di Firenze, JUN YE, JILA, NIST and University of Colorado Boulder — We implement high resolution, optical spectroscopy and spatially resolved readout of a lattice-trapped Fermi-degenerate gas of strontium. Here, correlations in the atomic signal between different spatial regions of the sample enable the most rapid evaluation of lattice induced clock shifts and a record fractional frequency precision of 2.5×10^{-19}. Additionally, we discuss current limits to atomic coherence times in optical lattices and prospects for improving them. In future work, these techniques can be directly applied to studies of long-range-interacting atomic dipoles and tests of general relativity at the millimeter scale.

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