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Using optical clock to probe quantum many-body physics

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The progress of optical lattice clock has benefited greatly from the understanding of atomic interactions. At the same time, the precision of clock spectroscopy has been applied to explore many-body spin interactions including $SU(N)$ symmetry. Our recent work on this combined front of quantum metrology and many-body physics includes the probe of spin-orbital physics in the lattice clock and the investigation of a Fermi degenerate gas of 10^5 ^{87}Sr atoms in a three-dimensional magic-wavelength optical lattice.