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**Interacting fermions under spin-orbit coupling in an optical lattice clock** SARAH BROMLEY, TOBIAS BOTHWELL, DHRUV KEDAR, SHIMON KOLKOWITZ, ARGHAVAN SAFAVI-NAINI, ANA MARIA REY, JUN YE, Univ of Colorado - Boulder — Synthetic gauge fields are a promising tool for creating complex Hamiltonians in ultracold neutral atom systems that may mimic the fractional Quantum Hall effect and other topological states. Interactions are a necessary ingredient for new phases and phenomena. To access the interplay between spin-orbit coupling (SOC) and interactions we study the density-dependent frequency shift in an optical lattice clock. Optical lattice clocks allow the SOC to occur naturally during clock interrogation when the clock laser imparts a lattice-site dependent phase on the atoms that becomes important when the atoms tunnel. For the case of spin polarized fermions, when tunneling is suppressed the differential phase imparted by the laser is irrelevant and only p-wave interaction occur. If tunneling is allowed then the site-dependent phase accumulated by the atoms open up the s-wave interaction channel.

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