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Accessing the quantum Hall regime in cold atom traps using circularly polarized light RACHEL WOOTEN, BIN YAN, CHRIS H. GREENE, Purdue University — There has been considerable interest in designing cold atom experiments to explore the quantum Hall effect with the extreme control allowed in such trapped atom systems. Many theoretical proposals and experimental attempts have been made in the effort to construct a cold atom fractional quantum Hall experiment, but so far, the fractional quantum Hall regime has proven difficult to achieve in experimental setups. One method for reaching the quantum Hall effect consists of rapidly rotating a cold atom system in a harmonic trap to near the centrifugal limit, where the system's Hamiltonian matches the two-dimensional magnetic field Hamiltonian. This condition could be reached in a few-body system through a scheme which increases the angular momentum of the particles in the trap through precision photon excitations. According to the hyperspherical framework from few-body theory, when particle interactions break the harmonic energy spectrum degeneracy, it becomes possible for circularly polarized light to excite the system selectively into the high angular momentum states required for the quantum Hall effect. We will discuss possible experimental systems where this technique could be applicable and challenges that these systems may face.

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