Abstract Submitted
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Two-dimensional optical quasicrystal potentials for ultracold atom experiments[1] THEODORE A. CORCOVILOS, Duquesne University, Pittsburgh, PA and Pittsburgh Quantum Institute, Pittsburgh, PA — Quasicrystals are nonperiodic arrangements of atoms having no translational symmetry but nonetheless possess long-range order. The mechanical, thermal, and electronic properties of quasicrystals, specifically their low-temperature behavior, defy easy description because of the difficulty in creating defect-free samples and the difficulty of simulating nonperiodic geometries. Quantum simulation using analogous systems such as ultracold atoms in optical lattice potentials provides an efficient investigative tool. We present a realistic optical design using nearly co-propagating beams that generates a 2-D quasicrystal potential with 10-fold symmetry. This geometry allows more control of the optical lattice geometry than the more common method of using co-planar beams and is easier to align. We also can generate phason excitations and quantized transport in the quasicrystal through phase modulation of the beams, giving us a direct route to study the topological properties of two-dimensional quasicrystals. Numerical simulation results of the optical system, including diffraction effects, and preliminary experimental data on the optics system will be presented.

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