Abstract Submitted
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Generating strong artificial magnetic fields, spin-orbit coupling, and non-abelian gauge fields with few lasers KADEN HAZZARD, JILA, NIST, University of Colorado-Boulder, ERICH MUELLER, Laboratory of Atomic and Solid State Physics, ANA MARIA REY, JILA, NIST, University of Colorado-Boulder — We propose an experimental scheme to generate strong gauge fields for atoms in an optical lattice, up to unit flux per plaquette, requiring fewer lasers than other proposals [1,2,3]. Like similar proposals [1,2], one generates a state-dependent lattice and couples adjacent sites with laser-induced tunneling. Our scheme, however, rectifies the resulting staggered magnetic flux to a homogeneous field using (experimentally feasible) "stroboscopic" time-dependent manipulation of the lattice lasers. One can generate sufficiently strong effective magnetic fields [U(1) gauge fields] to, for example, explore the interplay of fractional quantum Hall and lattice physics. For the case of alkaline earth atoms, the technique extends to generate SU(N) gauge fields, which are even richer. For example, simple homogeneous SU(2) gauge fields can be equivalent to spin-orbit coupling, which can host topological insulating phases even without interactions.

[1] D. Jaksch and P. Zoller, NJP 5, 56 (2003)
[2] F. Gerbier and J. Dalibard, NJP 12 033007 (2010)
[3] N. Cooper, PRL 106, 175301 (2011)

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