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Creating fractional quantum Hall states with atomic clusters using light-assisted insertion of angular momentum[1] JUNYI ZHANG[2], Princeton University, JEROME BEUGNON[3], SYLVAIN NASCIMBENE[4], Laboratoire Kastler Brossel — We describe a protocol to prepare clusters of ultracold bosonic atoms in strongly interacting states reminiscent of fractional quantum Hall states. Our scheme consists in injecting a controlled amount of angular momentum to an atomic gas using Raman transitions carrying orbital angular momentum. By injecting one unit of angular momentum per atom, one realizes a single-vortex state, which is well described by mean-field theory for large enough particle numbers. We also present schemes to realize fractional quantum Hall states, namely, the bosonic Laughlin and Moore-Read states. We investigate the requirements for adiabatic nucleation of such topological states, in particular comparing linear Landau-Zener ramps and arbitrary ramps obtained from optimized control methods. We also show that this protocol requires excellent control over the isotropic character of the trapping potential.

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