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Chiral Floquet Phases of Many-body Localized Bosons HOI CHUN PO, Department of Physics, Harvard University, Cambridge MA 02138, USA, LUKASZ FIDKOWSKI, Department of Physics and Astronomy, Stony Brook University, Stony Brook, NY 11794, USA, TAKAHIRO MORIMOTO, Department of Physics, University of California, Berkeley, CA 94720, USA, ANDREW C. POTTER, Department of Physics, University of Texas at Austin, Austin, TX 78712, USA, ASHVIN VISHWANATH, Department of Physics, Harvard University, Cambridge MA 02138, USA — We construct and classify chiral topological phases in driven (Floquet) systems of strongly interacting bosons, with finite-dimensional site Hilbert spaces, in two spatial dimensions. The construction proceeds by introducing exactly soluble models with chiral edges, which in the presence of many-body localization (MBL) in the bulk are argued to lead to stable chiral phases. These chiral phases do not require any symmetry, and in fact owe their existence to the absence of energy conservation in driven systems. Surprisingly, we show that they are classified by a quantized many-body index, which is well defined for any MBL Floquet system. The value of this index, which is always the logarithm of a positive rational number, can be interpreted as the entropy per Floquet cycle pumped along the edge, formalizing the notion of quantum-information flow. We explicitly compute this index for specific models, and show that the nontrivial topology leads to edge thermalization, which provides an interesting link between bulk topology and chaos at the edge. We also discuss chiral Floquet phases in interacting fermionic systems and their relation to chiral bosonic phases.

Hoi Chun Po
Department of Physics, Harvard University, Cambridge MA 02138, USA

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