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Exactly solvable $U(1) \times U(1)$ boson models for integer and fractional quantum Hall insulators in two dimensions OLEXEI MOTRUNICH, SCOTT GERAEDTS, California Institute of Technology — We present a solvable boson model with $U(1) \times U(1)$ symmetry in (2+1) dimensions that realizes insulating phases with a quantized Hall conductivity σ_{xy}. The model is short-ranged, with no topological terms, and can be realized by a local Hamiltonian. For one set of parameters, the model has a non-fractionalized phase with $\sigma_{xy} = 2n$ in appropriate units, with n an integer. In this case, the physical origin is dynamical binding between n bosons of one species and a vortex of the other species and condensation of such composites. Other choices for the parameters of the model yield a phase with $\sigma_{xy} = 2\frac{c}{d}$, where c and d are mutually prime integers. In this phase, c bosons dynamically bind to d vortices and such objects condense. The are two species of excitations that are bosonic by themselves but carry fractional charge $1/d$ and have mutual statistics $2\pi\frac{b}{d}$, where b is an integer such that $ad - bc = 1$, and a is also an integer. The model can be studied using sign-free Monte Carlo. We have performed simulations which include a boundary between a quantum Hall insulator and a trivial insulator, and found gapless edge states on the boundary.

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