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Mott Physics at Integer Filling Enforced by Crystalline Symmetries[1] D.P. AROVAS, Physics Department, UC San Diego, S.A. PARAMESWARAN, Physics Department, UC Berkeley, ARI M. TURNER, Institute for Theoretical Physics, University of Amsterdam, ASHVIN VISHWANATH, Physics Department, UC Berkeley — Insulating states of matter in a crystalline system can be either band insulators or Mott insulators. It is well known that band insulators appear only when the filling (the number of electrons per unit cell and spin projection) is an integer. An insulating phase at fractional filling is a Mott insulator, for which interactions are manifestly required. Here we pose and answer the converse question - at an integer filling is a band insulator always possible? Surprisingly, we find that crystalline symmetries may forbid a band insulator even at certain integer fillings. In these cases, the ground state is either conducting or is a Mott insulator, despite being at integer filling. The lattices on which this occurs have a simple property, they have non-symmorphic space groups. These include lattices with essential glide or screw symmetries, which comprise the majority of three dimensional crystal structures. This is shown to be a consequence of gauge invariance using a flux threading argument, which applies to free and interacting systems alike. For several non-symmorphic lattices we determine the minimum integer filling at which band insulators are possible. This result has several immediate implications for band structures as well as the phases of quantum magnets and bosonic insulat

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