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Berry-phase description of Topological Crystalline Insulators ARIS ALEXANDRADINATA, B. ANDREI BERNEVIG, Princeton University, XI DAI, Beijing National Laboratory for Condensed Matter Physics and Institute of Physics, Chinese Academy of Sciences — We study a class of translationally-invariant insulators protected by crystalline symmetries. Some of these insulators have no spin-orbit coupling, and may be realized in intrinsically spinless systems such as photonic crystals and ultra-cold atoms. Some of these insulators have no time-reversal symmetry as well, i.e., the relevant symmetries are purely crystalline. Nevertheless, topological phases exist which are distinguished by their robust surface modes. Their band topology is unveiled by the crystalline analog of Berry phases, i.e., parallel transport across certain non-contractible loops in the Brillouin zone. We also identify certain topological phases without any robust surface modes - they are uniquely distinguished by parallel transport along bent loops, whose shapes are determined by the symmetry group. Finally, we highlight recent interferometry experiments which demonstrate that these Berry phases are measurable.

Aris Alexandradinata
Princeton University

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