Abstract Submitted
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Space-time Crystal and Space-time group[1] CONGJUN WU, SHENGLONG XU[2], Department of Physics, University of California, San Diego — Crystal structures and the Bloch theorem play a fundamental role in condensed matter physics. We extend the static crystal to the dynamic "space-time" crystal characterized by the general intertwined space-time periodicities in D+1 dimensions, which include both the static crystal and the Floquet crystal as special cases. A new group structure dubbed "space-time" group is constructed to describe the discrete symmetries of space-time crystal. Compared to space and magnetic groups, space-time group is augmented by "time-screw" rotations and "time-glide" reflections involving fractional translations along the time direction. A complete classification of the 13 space-time groups in 1+1D is performed. The Kramers-type degeneracy can arise from the glide time-reversal symmetry without the half-integer spinor structure, which constrains the winding number patterns of spectral dispersions. In 2+1D, non-symmorphic space-time symmetries enforce spectral degeneracies, leading to protected Floquet semi-metal states. Our work provides a general framework for further studying topological properties of the D+1 dimensional space-time crystal.

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