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Gauging spatial symmetries and the classification of topological crystalline phases DOMINIC ELSE, Department of Physics, University of California, Santa Barbara , RYAN THORNGREN, Department of Mathematics, University of California, Berkeley — A *topological crystalline* phase of matter is a topological phase protected by space-group symmetries. The prototypical examples are the so-called "topological crystalline insulators". For strongly interacting topological crystalline phases, there is as yet no systematic theory. This is in contrast to the case of *internal* symmetries, where coupling to a background gauge field allows one to derive a systematic classification. In this work, we elucidate what it means to gauge a spatial symmetry, allowing us to give a systematic classification of topological crystalline phases. Our work applies to a subset of topological crystalline phases which we call "topological crystalline liquids"; we conjecture that this subset includes nearly all topological crystalline phases, with the exception of states with exotic fracton excitations such as the "Haah code". As an example, we classify bosonic topological crystalline liquids for all 230 space groups.

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