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**Universal crystal structures in hard and soft matter systems** JULIA DSHEMUCHADSE, University of Michigan, MICHAEL ENGEL, Friedrich-Alexander-University Erlangen-Nuremberg, SHARON C. GLOTZER, University of Michigan — Increasingly complex structures, from large cluster-based unit cells to quasicrystals, are being discovered in soft-matter systems in both experimental and computational studies. Several of these were previously known from compounds on the atomic scale, while others are novel. We perform high-throughput molecular-dynamics simulations of interacting particles to screen large sections of phase space. After analyzing the resulting data crystallographically, we investigate the conditions under which complex structures with large unit cells and diverse symmetries form in different kinds of soft-matter systems. These insights enable the targeted design of soft matter structures by an intelligent choice of building blocks. On the other hand, the agnostic treatment of the interaction potentials will help us distill the decisive factors that lead to the formation of any particular crystal structure.

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