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Mechanics of Miura-ori Origami Lattice Defects JESSE SILVERBERG, LAUREN MCLEOD, Physics Department, Cornell University, ARTHUR EVANS, Department of Physics, University of Massachusetts, Amherst, JESSICA GINEPRO, Department of Mathematics, Western New England University, CHRISTIAN SANTANGELO, Department of Physics, University of Massachusetts, Amherst, THOMAS HULL, Department of Mathematics, Western New England University, ITAI COHEN, Physics Department, Cornell University — The mechanical properties of origami-inspired materials show remarkable potential for responsive, tunable next-generation materials. For example, the Miura-ori fold is predicted to have negative Poisson ratio and anisotropic compressive properties. Using a custom mechanical testing device and 3D laser profilometry, we investigate the moduli and the role of curvature in setting these material properties. Because defects are known to dramatically alter the bulk properties in other periodic materials, we introduce defects into the folding pattern to investigate their effects on the macroscopic mechanical properties. Interestingly, we find that a single defect increases the overall material stiffness, but the introduction of a second defect in the opposite direction can cancel out the first, tending to restore the original material properties. Moreover, these defect pairs can be arranged to form edge dislocations, grain boundaries, and many other topological configurations familiar from the study of crystallographic lattice defects.

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