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Emergent structure in a dipolar Bose gas in a one-dimensional lattice RYAN WILSON, JOHN BOHN, JILA, NIST and Department of Physics, University of Colorado, Boulder, Colorado 80309, USA — We consider an ultracold dipolar Bose gas in a one-dimensional lattice. For a sufficiently large lattice recoil energy, such a system becomes a series of non-overlapping Bose-Einstein condensates that interact via the long-range dipole-dipole interaction (ddi). We model this system via a coupled set of non-local Gross-Pitaevskii equations (GPEs) for lattices of both infinite and finite extent. We find significantly modified stability properties in the lattice due to the softening of a discrete roton-like mode, as well as "islands" in parameter space where biconcave densities are predicted to exist that only exist in the presence of the other condensates on the lattice. We solve for the elementary excitations of the system to check the dynamical stability of these solutions and to uncover the nature of their collapse. By solving a coupled set of GPEs exactly on a full numeric grid, we show that this emergent biconcave structure can be realized in a finite lattice with atomic ^{52}Cr.

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