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Defect dynamics in nonlinear photonic quasicrystals BARAK FREEDMAN, GUY BARTAL, MORDECHAI SEGEV, Technion, RON LIFSHITZ, Tel Aviv University, DEMETRIOS N. CHRISTODOULIDES, University of Central Florida, JASON W. FLEISCHER, Princeton — Quasicrystals are structures with long-range order and no periodicity, with unique properties that arise from their broken-symmetry state. These include a hierarchy of effective Brillouin (Jones) zones, yielding a fractal-like band structure, and the existence of Goldstone-mode "phason" degrees of freedom. Here, we examine these features using optically-induced quasicrystals in nonlinear photorefractive media, taking advantage of the fact that internal wave dynamics can be locally excited and directly imaged. In particular, we report the direct observation of dislocation dynamics in a deformable quasicrystal (one whose sites interact with each other): creation, healing, and local structural rearrangement due to phason flips. Our experiments show that photonic quasicrystals are excellent model systems for studying universal features of wave dynamics in quasiperiodic structures, not only in optics but also in other systems, e.g. matter waves in quasiperiodic traps, parametrically-driven pattern-forming systems, and liquid and atomic quasicrystals.

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