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Nonlinear wave scattering by small barrier potentials WENJIE WAN, JASON W. FLEISCHER, Princeton University — Scattering by a barrier potential is a fundamental problem in wave physics, involving issues of boundary conditions, resonances, radiation, etc. While scattering in the linear case is well-known, the nonlinear case has received far less attention. In the nonlinear regime, self-interaction affects tunneling and re-radiation dynamics, often leading to new topological structures (e.g. dark solitons and vortices). Examples include many-body quantum systems, plasmas, and nonlinear optics. Here, we focus on the optical case by considering plane-wave scattering from an optically-induced barrier potential (step index) inside a photorefractive crystal. We experimentally demonstrate shock wave formation (dark soliton trains) in 1D and vortex generation in 2D, as a function of barrier height and input wave angle. We show numerically that these results arise from a combination of tunneling, scattering, and optical superflow around the boundary. Applications both within and beyond optics will be discussed.

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