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Dispersive shock waves with negative pressure WENJIE WAN, DMITRI DYLOV, CHRISTOPHER BARSI , JASON FLEISCHER, Princeton University — Dispersive shock waves (DSWs) arise from nonlinear wave breaking and mode dispersion and are a fundamental type of fluid behavior. In normal fluid systems, the pressure is positive and repulsive, so that the underlying particles resist compression. Examples include water, plasma, and optical beams with self-defocusing nonlinearity. However, there are systems in which the interactions are attractive, resulting in an effectively negative pressure. Here, we demonstrate that dispersive shock waves can arise in these negative-pressure systems by considering the equivalent optical problem with self-focusing nonlinearity. Using partially-coherent light, to prevent the competition of modulation instability, we experimentally observe DSWs formed in a self-compressive beam in a photorefractive crystal. We characterize the nonlinear speed and profile of the DSWs and show that statistical de-phasing by the incoherent beam causes an effective Landau damping of the waves. Observations are supported both by analytic theory and numerical simulation.

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