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Observation of shock waves in a unitary Fermi gas JAMES JOSEPH, Duke University, MANAS KULKARNI, ALEXANDER ABANOV, Stony Brook University, JOHN THOMAS, Duke University — We study the nonlinear hydrodynamics of a strongly interacting (unitary) Fermi gas comprising a 50-50 mixture of the lowest two hyperfine states of ^{6}Li near a broad Feshbach resonance at 834 G. The gas is is cooled via forced evaporation in a cigar-shaped CO_2 laser trap with a repulsive optical sheet potential at the center creating two separate clouds. When the repulsive potential is turned off and the two clouds collide we observe exotic nonlinear hydrodynamics distinguished by the formation of a very sharp and stable density peak at the center of the trap and subsequent evolution into a box-like shape with sharp edges. We attribute these characteristics to shock-wave formation in the unitary gas. By solving the hydrodynamic equations numerically we can reproduce the time dependence of the observed density profiles.

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