Abstract Submitted
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2D analysis of shock waves in a unitary Fermi-gas JAMES JOSEPH, Duke University — We study the nonlinear hydrodynamics of a strongly interacting 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. Taking advantage of the laser trap's cylindrical symmetry, we solve the zero temperature hydrodynamic equations numerically in two dimensions. As a result, the numerical simulation provides the three dimensional density and velocity fields. We fit the density field to our experimental data using shear viscosity as our only fitting parameter. Further, we use the density and velocity fields provided by the simulation to calculate the total mechanical energy of the atoms.

James Joseph
Duke University

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