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Hydrodynamics of a cold one-dimensional fluid: the problem of strong shock waves PABLO I. HURTADO, PAUL L. KRAPIVSKY, Department of Physics, Boston University — We study a shock wave induced by an infinitely massive piston propagating into a one-dimensional cold gas. The cold gas is modelled as a collection of hard rods which are initially at rest, so the temperature is zero. Most of our results are based on simulations of a gas of rods with binary mass distribution, and we partcularly focus on the case of spatially alternating masses. We find that the properties of the resulting shock wave are in striking contrast with those predicted by hydrodynamic and kinetic approaches, e.g., the flow-field profiles relax algebraically toward their equilibrium values. In addition, most relevant observables characterizing local thermodynamic equilibrium and equipartition decay as a power law of the distance to the shock layer. The exponents of these power laws depend non-monotonously on the mass ratio. Similar interesting dependences on the mass ratio also characterize the shock width, density and temperature overshoots, etc.

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