HYPERBOLIC SCALING LIMITS IN A REGIME OF SHOCK WAVES

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The Euler equations of hydrodynamics develop shocks in a finite time, in such situations the derivation of the macroscopic equations from a microscopic model requires a synthesis of probabilistic and PDE methods. In the case of two-component stochastic models with a hyperbolic scaling law the method of compensated compactness seems to be the only tool that we can apply. Since the associated Lax entropies are not preserved by the microscopic dynamics, a logarithmic Sobolev inequality is needed to evaluate entropy production. Extending the arguments of J. W. Shearer and Serre–Shearer to stochastic systems, the nonlinear wave equation of isentropic elastodynamics is derived as the hyperbolic scaling limit of the anharmonic chain with Ginzburg–Landau type random perturbations. The model of interacting exclusion of charged particles results in the Leroux system in a similar way. In the presence of an additional creation-annihilation mechanism the missing logarithmic Sobolev inequality is replaced by an associated relaxation scheme. In this case the uniqueness of the limit is also known.