Abstract Submitted
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A finite volume scheme for stochastic PDEs in the context of fluctuating hydrodynamics[1] SERGIO P. PEREZ, ANTONIO RUSSO, MIGUEL A. DURAN-OLIVENCIA, PETER YATSYSHIN, JOSE A. CARRILLO, SERAFIM KALLIADASIS, Imperial College London — The description of soft matter systems out of equilibrium requires the inclusion of fluctuations in the standard hydrodynamic equations for the evolution of conserved quantities. The associated general framework was postulated phenomenologically by Landau et. al., yielding what is known as Landau-Lifshitz fluctuating hydrodynamics. However, the numerical applicability of the fluctuating hydrodynamics entails several challenges which still remain elusive. In particular, conservative fluctuations, i.e. stochastic fluxes under the gradient operator, need to be properly accounted for. Besides, even for the simplest limit of these equations (which corresponds to the stochastic diffusion equation), the presence of a normally-distributed flux in the time-evolution equation for the density involves non-positive solutions, which are clearly unphysical. Hence the need for a robust method capable of handling stochastic fluctuations properly. Here we present a finite-volume scheme for stochastic gradient flows with nonlinear energy functionals, based on a hybrid upwind-central discretisation of both the deterministic and stochastic fluxes. The positivity of the density is ensured by an innovative time-adapting procedure based on the concept of Brownian trees. We exemplify the applicability and versatility of our method by solving the FH in a wide spectrum of physical settings.

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