Large deviations of Landau-Lifschitz-Navier-Stokes and the Energy Equality

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Abstract

The Landau-Lifshitz-Navier-Stokes equations are stochastic partial differential equations (SPDEs) incorporating a stochastic forcing term to model macroscopic fluctuations that deviate from the deterministic Navier-Stokes equations.

In dimension $d = 3$, we examine the large deviation principle within a scaling regime wherein both the noise intensity and the correlation length simultaneously tend to zero, governed by a coupled rate. Our findings demonstrate that the resulting large deviations align with those identified in the lattice gas model by Quastel and Yau. This correspondence supports the stochastic Landau-Lifshitz-Navier-Stokes equations as an effective and computationally viable model for capturing deviations from the deterministic limit.

Furthermore, the large deviation results provide an argument linking weak-strong uniqueness with scenarios in which the classical energy inequality holds as an equality.

*Punctual, i.e. sine tempore!