Convergence of a finite-volume scheme for a stochastic heat equation with nonlinear multiplicative noise

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We study an approximation by a finite-volume scheme in space and a semi-implicit discretization in time for a stochastic heat equation driven by a Lipschitz continuous multiplicative noise. Here the nonlinearity in the stochastic integral leads to a lack of compactness. More precisely, the weak convergence of our finite-volume approximations that we obtain by *a priori* estimates is not enough to identify the weak limit in the nonlinear term in the stochastic integral. Therefore we use the stochastic compactness method based on Skorokhod's representation theorem to get the convergence of our finite-volume approximations to a martingale solution. By a pathwise uniqueness argument we then get stochastically strong convergence to the unique variational solution of our parabolic problem.

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