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Stochastic PDEs with heavy-tailed noise

We analyze the nonlinear stochastic heat equation driven by heavy-tailed noise in free space and arbitrary dimension. The existence of a solution is proved even if the noise only has moments up to an order strictly smaller than its Blumenthal-Getoor index. In particular, this includes all stable noises with index $\alpha < 1 + 2/d$. Although we cannot show uniqueness, the constructed solution is natural in the sense that it is the limit of the solutions to approximative equations obtained by truncating the big jumps of the noise or by restricting its support to a compact set in space. Under growth conditions on the nonlinear term we can further derive moment estimates of the solution, uniformly in space. Finally, the techniques are shown to apply to Volterra equations with kernels bounded by generalized Gaussian densities. This includes, for instance, a large class of uniformly parabolic stochastic PDEs.