Global solutions to reaction-diffusion equations with super-linear drift and multiplicative noise

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Abstract. We consider a stochastic heat equation with additive non-linearity b and multiplicative non-linearity σ, in the case where the drift b is super-linear: $|b(z)| \geq |z|(\log|z|)^{1+\varepsilon}$, for some $\varepsilon > 0$. When $\sigma \equiv 0$, it is well known that such PDEs frequently have non-trivial stationary solutions. By contrast, Bonder and Groisman (2009) have shown that when σ is constant and $\sigma \neq 0$, there is finite-time blowup. We prove that the Bonder–Groisman condition is unimproveable by showing that the reaction-diffusion equation with noise is "typically" well posed when $|b(z)| = O(|z| \log_+ |z|)$ as $|z| \to \infty$. This is joint work with Davar Khoshnevisan (University of Utah) and Tusheng Zhang (University of Manchester).

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