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Global solutions for the stochastic reaction-diffusion equation with polynomially dissipative forcing

We identify a condition that implies that solutions to the stochastic reaction-diffusion equation $\frac{\partial u}{\partial t} = \mathcal{A}u + f(u) + \sigma(u)\dot{W}$ on a bounded spatial domain never blow up. We consider the case where f features polynomial dissipativity of the form $f(u)\text{sign}(u) \leq \check{}K_1|u|^\beta$ for $\beta > 1$ and $|u|$ large. This kind of strong dissipation prevents solutions from blowing up even when the multiplicative noise coefficient grows polynomially like $|\sigma(u)| \leq K_2(1+|u|^\gamma)$ as long as $\gamma < 1 + \frac{(1-\eta)(\beta-1)}{2}$. The constant $\eta \in (0,1)$ is a scalar that describes a relationship between the eigenvalues of the of linear operator and the eigenvalues of the Gaussian noise.