

A priori bounds for the nonlinear Parabolic Anderson Model

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Abstract

We show a priori bounds that exclude finite time explosion for the solution of the nonlinear (or generalised) Parabolic Anderson model (gPAM)

$$(\partial_t - \Delta)u = \sigma(u)\xi$$

in the framework of Hairer's regularity structures. gPAM is the archetype of an equation that can be treated using regularity structures and it was one of the first equations for which a local solution theory was developed using this theory.

While global existence in the linear case $\sigma(u) = u$ follows from Hairer's original work [Hairer, Inventiones 2014] and also [Gubinelli, Imkeller, Perkowski FoM, Pi 2015], the case of non-linear σ is significantly more challenging and has remained open so far. Our results apply to noise terms ξ of (ir)regularity $> -1 - \kappa$ for some $\kappa > 0$, including in particular the case of 2-dimensional spacial white noise. As a corollary we obtain global existence and the existence of an invariant measure for the dynamic Sine-Gordon model on the two-dimensional torus in the regime $\beta^2 \in (4\pi, (1 + \kappa)4\pi)$.

This is joint work with Guilherme Feltes (Münster) and Ajay Chandra (Imperial College)

*Punctual, i.e. sine tempore!