COLLOQUIUM

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On the Chaotic Character of Some Parabolic Stochastic PDEs

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10:20 a.m. - 11:10 a.m.
Refreshments: 10:00 a.m.

Abstract

Summary: We consider a nonlinear stochastic heat equation $\partial_t u = (1/2)\partial_{xx} u + \sigma(u)\eta$, where η denotes space-time white noise in dimension (1+1), and σ is Lipschitz continuous. We establish that, at every fixed time $t > 0$, the global behavior of the solution depends in a critical matter on the structure of the initial function u_0: Under suitable technical conditions on u_0 and σ, $\sup_{|x|<R} u_t(x)$ remains bounded as $R \to \infty$ when u_0 has compact support. Whereas with probability one, $\sup_{|x|<R} u_t(x) \geq const \cdot (R)^{1/6}$ when u_0 is bounded uniformly away from zero. The mentioned sensitivity to the initial data of the stochastic heat equation is a way to state that the solution to the stochastic heat equation is *chaotic* at fixed times, well before the onset of intermittency.

Time permitting, we will also discuss: (1) What happens if the forcing term has spatial correlations; and (2) More detailed growth estimates for special families of nonlinearities σ. In particular, we describe the high-level oscillations of "the solution" to the so-called KPZ equation of Kardar, Parisi, and Zhang (1986).

This is joint work with Daniel Conus, Mathew Joseph, and Shang-Yuan Shiu.

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