Non-negative Martingale Solutions to the Stochastic Thin-Film Equation with Nonlinear Gradient Noise

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We prove the existence of non-negative martingale solutions to a class of stochastic degenerate-parabolic fourth-order PDEs arising in surface-tension driven thin-film flow influenced by thermal noise. The construction applies to a range of mobilites including the cubic one which occurs under the assumption of a no-slip condition at the liquid-solid interface. Since their introduction more than 15 years ago, by Davidovitch, Moro, and Stone and by Grün, Mecke, and Rauscher, the existence of solutions to stochastic thin-film equations for cubic mobilities has been an open problem, even in the case of sufficiently regular noise. Our proof of global-in-time solutions relies on a careful combination of entropy and energy estimates in conjunction with a tailor-made approximation procedure to control the formation of shocks caused by the nonlinear stochastic scalar conservation law structure of the noise. The passage to solutions with non-full support of the initial data using alpha entropies in a range of sub-cubic mobilities will be discussed.
The talk is based on joint works with Konstantinos Dareiotis (University of Leeds), Benjamin Gess (Bielefeld University/MPI Leipzig), Günther Grün (University of Erlangen-Nuremberg), and Max Sauerbrey (TU Delft).