Wave front propagation for FKPP reaction-diffusion equation on a class of infinite random trees

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Abstract

The asymptotic wave speed for FKPP type reaction-diffusion equations on a class of infinite random metric trees is considered in this talk. We show that a travelling wave front emerges, provided that the reaction rate is large enough. The wave travels at a speed that can be quantified via a variational formula involving the random branching degrees and the random branch lengths of the tree. This speed is slower than that of the same equation on the real line, and we can estimate this slow-down in terms of the structure of the tree. Our key idea is to project the Brownian motion on the tree onto a one-dimensional axis along the direction of the wave propagation. This idea, combined with the Feynman–Kac formula, connect our analysis of the wave front propagation to the Large Deviations Principle (LDP) of the multi-skewed Brownian motion with random skewness and random interface set. Our LDP analysis for this multi-skewed Brownian motion involves delicate estimates for an infinite product of 2 by 2 random matrices parametrized by the structure of the tree and for hitting times of a random walk in random environment. Joint work with Wai-Tong (Louis) Fan (Indiana University) and Grigory Terlov (UIUC).