**Last passage percolation and limit theorems in Barak-Erdős directed random graphs and related models**

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We present a survey of a body of work concerning a class of random graphs that arise in probability theory, physics and computer science and which can also be seen as microscopic models of the famous FKPP (Fisher-Kolmogorov-Petrovsky-Piskunov) partial differential equation $\partial_t u = \partial_{xx} u + u(1-u)\epsilon_N$ arising in statistical physics, population genetics, and reaction–diffusion theory.

A central issue here is the existence of a traveling wave solution and the speed $v_N$ at which it travels as a function of $N$ when $\epsilon_N \to 0$. In microscopic stochastic models, finite-size effects produce corrections to the limiting FKPP wave speed. These corrections were first derived heuristically by Brunet and Derrida.

The Barak-Erdős graph has a parameter $p$ and a last passage percolation constant $C(p)$ which turns out to be closely related to the speed $v_N$ when $p \to 0$ appropriately as $N \to \infty$.

Independently of these connections, the Barak-Erdős graph is itself the standard directed version of the ubiquitus Erdős-Rényi graph and therefore appears naturally in several areas of probability and combinatorics.

In this talk we explain some of these connections and present the theory of the Barak–Erdős graph, with particular emphasis on the so-called infinite-bin model.

Last-passage percolation concerns the longest (or, in weighted settings, heaviest) path between distant vertices of a graph. Besides being an important problem in its own right, it is closely related to stability questions in certain queueing network models.

The talk highlights interactions between several areas of mathematics and neighboring sciences. We will also discuss perfect simulation algorithms that enable the estimation of the last-passage percolation constant.