北京师范大学 随机数学研究中心
学术报告

题 目: Central limit theorem and precise large deviations for branching random walks with products of random matrices

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摘 要： A branching random walk is a system of particles, in which each particle gives birth to new particles of the next generation, which move on $\mathbb{R}^d$ according to some probability law. In the classical model, a particle whose parent is at position y, moves to position $y+l$ with independent and identically distributed (i.i.d.) increments l for different particles, so that the moving is a simple random translation. This model does not cover the interesting cases occurring in many problems where the movements are determined by linear transformations such as rotations, dilations, shears, reflections, projections etc. In this talk, we consider the case where the position of a particle is obtained by the action of a matrix A on the position of its parent, where the matrices A's corresponding to different particles are i.i.d. This permits us to extend significantly the domains of applications of the theory of branching random walks.

We are interested in asymptotic properties of the counting measure Z_n^x which counts the number of particles of generation n situated in a given region, when the process starts with one initial particle located at x. The study of the measure Z_n^x is interesting because it describes the configuration of the process at time n. We establish a central limit theorem and a large deviation asymptotic expansion of Bahadur-Rao type for Z_n^x with suitable norming. An integral version of the large deviation result is also established. One of the key points in the proofs is the study of the fundamental martingale related to the spectral gap theory for products of random matrices. As a by-product, we obtain a sufficient and necessary condition for the non-degeneracy of the limit of the fundamental martingale, which extends the Kesten-Stigum type theorem of Biggins. (Based on a joint work with Thi Thuy Bui and Ion Grama.)