Large deviation principle for binomial Gibbs processes

Martina Petráková

Co-author: Christian Hirsch (Department of Mathematics, Aarhus University)

Abstract: Gibbs processes in the continuum are one of the most fundamental models in spatial stochastics. They are typically defined using a density with respect to the Poisson point process. In the language of statistical mechanics, this corresponds to the grand-canonical ensemble, where the number of particles is random. Of the same importance is the canonical ensemble, where the number of particles is fixed. In the language of point processes, this corresponds to studying binomial Gibbs processes which are defined using a density with respect to the binomial point process.

In this talk, we present a large deviation theory developed for functionals of binomial Gibbs processes with fixed intensity in increasing windows. Our method relies on the traditional large deviation result from [1] noting that the binomial point process is obtained from the Poisson point process by conditioning on the point number. Our main methodological contribution is the development of coupling constructions allowing us to handle delicate and unlikely pathological events. The presented results cover a broad class of both the interaction function (possibly unbounded) and the functionals (given as a sum of possibly unbounded local score functions).

[1] Georgii, H.-O. and Zessin, H. (1993): Large deviations and the maximum entropy principle for marked point random fields, Probab. Theory Related Fields 96, 177–204.