The limit theory of isolated and extreme points in hyperbolic random graphs

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In this talk we will consider the distribution of isolated and extreme points in random graphs on the hyperbolic plane of curvature $-\alpha^2$. The model we will consider was introduced by Krioukov et al. (*Phys. Rev. E*, 2010) and was motivated by the theory of complex networks. It postulates the emergence of typical properties of complex networks such as sparseness, power law degree distribution, clustering and small average distance, as the expression of a hidden underlying hyperbolic geometry when $\alpha > 1/2$.

We study how the distribution of isolated and extreme points in such a random graph depends on the parameter α. We find that both the expectation and the variance of the number of extreme points scales linearly on the number of vertices n and it satisfies a central limit theorem as $n \to \infty$ for all $\alpha > 1/2$. However, the number of isolated points satisfies this only for $\alpha > 1$. We show that when $1/2 < \alpha < 1$, its variance scales super-linearly in n and it does not satisfy a central limit theorem.

This is joint work with Joe Yukich (Lehigh University, USA).