Random graphs and its applications for networks

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Poisson-Voronoi graph on a Riemannian manifold.

In this talk, we consider a Riemannian manifold M and the Voronoi graph generated by the union of a fixed point x and a Poisson point process of intensity measure proportional to the volume measure of M. The aim is to connect the information of discrete nature of the random graph with the properties of the manifold itself which is a continuous object. We obtain asymptotic expansions up to the second order for the means of several characteristics of the Voronoi cell associated with x. In particular, the scalar curvature at x appears in the second term of the expansion of the mean number of vertices. This implies a probabilistic proof of the Gauss-Bonnet Theorem in dimension two. Moreover, we also deduce from that expansion the construction of a new estimator of the scalar curvature. The estimator is proved to have an explicit asymptotic variance and to satisfy a central limit theorem with precise convergence rate.

This talk is based on several joint works with Aurélie Chapron and Nathanaël Enriquez.