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Scaling limits of large random trees

Large scale behavior of random trees has been the object of an intense research for both combinatorists and probabilists for a few decades. Initially the research focused on certain statistics of the trees: height of a typical vertex, maximal height, diameter, etc. A turning point came in the early 90s with the pioneering work of Aldous on the Brownian continuum random tree (CRT): Aldous proved that a critical Galton-Watson tree with a finite variance offspring distribution, seen as a metric space and properly rescaled, converges towards the CRT. Actually, as for random walks, there is an invariance principle: many classes of random trees are known to converge after rescaling towards the CRT. However other limits are also possible, among which two important classes of continuous trees: the stables Lévy trees introduced by Duquesne, Le Gall and Le Jan (which are the scaling limits of critical Galton-Watson trees with an offspring distribution in the domain of attraction of a stable law) and the fragmentation trees (which are the scaling limits of the so-called Markov branching trees).
In this talk we will first review classical results on scaling limits of random trees, in particular those of Aldous and Duquesne on scaling limits of Galton-Watson trees. We will then turn to the scaling limits of Markov branching trees, which is the content of a work done jointly with Grégory Miermont. Several applications will be discussed.