Minisymposium 19 - Random Discrete Structures and Algorithms

Central and local limit theorems for the giant component

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Erdős and Rényi observed that in a random graph $G_{n,p}$ (or $G_{n,m}$) there occurs a *phase transition* as the average degree np (resp. $2m/n$) passes 1: if $np < 1-\epsilon$ for an arbitrarily small but fixed $\epsilon > 0$, then all connected components of $G_{n,p}$ have at most logarithmic size, while for $np > 1+\epsilon$ there is a "giant" component of linear size asymptotically almost surely as $n \to \infty$. Erdős and Rényi also computed the expected number of vertices/edges in the giant component. In this talk I present a novel approach to determining the actual *distribution* of the number of vertices/edges inside of the giant component. The techniques are purely probabilistic and include "Stein's method" as well as a bit of Fourier analysis. As a by-product, these techniques yield a new proof of Bender, Canfield, and McKay's forumla for the asymptotic number of connected graphs with a given number of vertices/edges. This is joint work with Michael Behrisch and Mihyun Kang.