Gaussian complex zeros on the hole event: the emergence of a forbidden region

Abstract:

Consider the Gaussian Entire Function (GEF) whose Taylor coefficients are independent complex-valued Gaussian variables, and the variance of the $k$-th coefficient is $1/k!$. This random Taylor series is distinguished by the invariance of its zero set with respect to the isometries of the complex plane. I will show that the law of the zero set, conditioned on the GEF having no zeros in a disk of radius $r$, and properly normalized, converges to an explicit limiting Radon measure in the plane, as $r$ goes to infinity. A remarkable feature of this limiting measure is the existence of a large 'forbidden region' between a singular part supported on the boundary of the (scaled) hole and the equilibrium measure far from the hole. This answers a question posed by Nazarov and Sodin, and is in stark contrast to the corresponding result known to hold in the random matrix setting, where such a gap does not appear. The talk is based on a joint work with S. Ghosh.