Two Manifestations of Rigidity in Point Sets: Forbidden Regions and Maximal Degeneracy

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A point process is said to be "rigid" if its local observables are completely determined (as deterministic functions of) the point configuration outside a local neighbourhood. For example, it has been shown in earlier work that, in the Ginibre ensemble (a.k.a. the 2D Coulomb gas at inverse temperature beta=2), the point configuration outside any bounded domain determines, almost surely, the number of points in the domain.

In this talk, we will explore two recent manifestations of such rigidity phenomena. For the zeros of the planar Gaussian analytic function, we show that outside every large "hole", there is a "forbidden region" which contains a vanishing density of points. This should be seen in contrast with the corresponding situation for classically understood models (e.g. random matrix ensembles), where no such effects are known to occur.

In the second part of the talk, we will consider "stealthy" hyperuniform systems, which are systems whose structure function (i.e., the Fourier transform of the two-point correlation) vanishes near the origin. We show that such systems exhibit "maximal degeneracy", namely the points outside a bounded domain determine, almost surely, the entire point configuration inside the domain. En route, we establish a conjecture of Zhang, Stillinger and Torquato that such systems have (deterministically) bounded holes.

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