Laboratoire de Physique Théorique et Hautes Energies

Unité Mixte de Recherche (UMR 7589) de Sorbonne Université et du CNRS

SEMINAIRE du LPTHE

Vendredi 18 Mai 2018, 11:00

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LPTMS Orsay

Non-interacting trapped fermions : from GUE to multi-critical matrix models

We will discuss a system of N one-dimensional free fermions confined by a harmonic well. At zero temperature,, this system is intimately connected to random matrices belonging to the Gaussian Unitary Ensemble (GUE). In particular, the spatial density of fermions has, for large N, a finite support and it is given by the Wigner semi-circular law. Besides, close to the edges of the support, the spatial quantum fluctuations are described by the so-called Airy-Kernel, which plays an important role in random matrix theory. We will then focus on the joint statistics of the momenta, with a particular focus on the largest one $p_{\max}$*. For the harmonic trap, momenta and positions play a symmetric role and hence the joint statistics of momenta is identical to that of the positions. Here we show that novel "momentum edge statistics" emerge when the curvature of the potential vanishes, i.e. for "flat traps" near their minimum, with* $V(x) \sim x^{2n}$ *and* $n > 1$*. These are based on generalisations of the Airy kernel that we obtain explicitly. The fluctuations of* $p_{\max}$ *are governed by new universal distributions determined from the* n*-th member of the second Painlevé hierarchy of non-linear differential equations, with connections to multi-critical random matrix models, which have been discussed, in the past, in the string theory literature.*

Bibliothèque du LPTHE, tour 13/14, 4ème étage

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