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Random Matrices and Dyson Brownian Motion.

Wigner envisioned that the spectral statistics of large interacting quantum systems can be modeled by those of random matrices. A prominent example of this vision is the Wigner-Dyson-Mehta conjecture asserting that the spectral statistics of random matrices depend only on the symmetry classes but are independent of the distributions of matrix elements. Dyson proposed to study the dynamics of the eigenvalues of random matrices if all matrix elements evolved by Brownian motions. The induced evolution of these eigenvalues is called Dyson Brownian motion. Dyson observed that this dynamics approaches equilibrium in two time scales: a slow relaxation for global modes and a fast one for local fluctuations. We will show that this fundamental observation can indeed be made rigorous and it is in fact the cornerstone of the recent solution of Wigner-Dyson-Mehta conjecture. Related progress in random matrix theory will also be discussed. (Received September 17, 2013)