

DYSONIAN DYNAMICS OF THE GINIBRE ENSEMBLE

Maciej Nowak

Jagiellonian University, Poland

nowak@th.if.uj.edu.pl

We study the time evolution of Ginibre matrices whose elements undergo Brownian motion. The non-Hermitian character of the Ginibre ensemble binds the dynamics of eigenvalues to the evolution of eigenvectors in a nontrivial way, leading to a system of coupled nonlinear equations resembling those for turbulent systems. We formulate a mathematical framework allowing simultaneous description of the flow of eigenvalues and eigenvectors, and we unravel a hidden dynamics as a function of a new complex variable, which in the standard description is treated as a regulator only. We solve the evolution equations for large matrices and demonstrate that the nonanalytic behavior of the Green's functions is associated with a shock wave stemming from a Burgers-like equation describing correlations of eigenvectors. We conjecture that the hidden dynamics that we observe for the Ginibre ensemble is a general feature of non-Hermitian random matrix models and is relevant to related physical applications.