Title: Functional Central Limit Theorems for Wigner Matrices

Consider the random variable $X := \mathrm{Tr}(f_1(W)A_1 \ldots f_k(W)A_k)$ where W is a Hermitian Wigner matrix, $k \in \mathbb{N}$, and we choose regular functions $f_1, \ldots, f_k$ as well as bounded deterministic matrices $A_1, \ldots, A_k$. In this talk, we study the fluctuations around $\mathbb{E}X$ and give a functional central limit theorem on macroscopic and mesoscopic scales. Analyzing the underlying combinatorics further leads to explicit formulas for the variance of X as well as the covariance of X and $Y := \mathrm{Tr}(f_{k+1}(W)A_{k+1} \ldots f_{k+\ell}(W)A_{k+\ell})$ of similar build. The results obtained match the structure of formulas in second-order free probability which were previously only available for f_j being polynomials.