

Caltech Mathematical Physics Seminar
Fall 2008–09

Powers of Large Random Unitary Matrices and Toeplitz Determinants

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Abstract. I will report on joint work with Kurt Johansson on the limiting behavior of traces of powers of random unitary matrices. More precisely, we study the limiting behavior of $\text{Tr } U_n^{k(n)}$, where U_n is an $n \times n$ random unitary matrix and $k(n)$ is a natural number that may vary with n in an arbitrary way. Our main result is a Strong Szegő Limit Theorem for Toeplitz matrices for which the symbol varies with the size of the matrix in a particular way. As a corollary, we obtain that the random variables $\text{Tr } U_n^{k_j(n)} / \sqrt{\min(k_j(n), n)}$, $j = 1, \dots, m$, converge to independent standard complex normals as $n \rightarrow \infty$.