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The Fluctuations of Kesten's Law

In 1959, Harry Kesten found the distribution of random walks on the free group on n generators, now known as Kesten's law. This law is the additive free convolution of the arcsine law with itself, n times. Kesten's law is also the limiting eigenvalue distribution of $X_N = U_1 + U_1^{-1} + \cdots + U_n + U_n^{-1}$ where $\{U_1, \ldots, U_n\}$ are independent $N \times N$ Haar distributed random unitary matrices. I shall present the limiting fluctuations of the random variables $\{\mathrm{Tr}(X_N^k)\}_k$ and the orthogonal polynomials that diagonalize them.

This is joint work with Craig Armstrong, Roland Speicher, and Jenny Wilson.