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Asymptotics of unitary multimatrix models

A fundamental result of Voiculescu gives algebraic machinery for computing the large N limit of the normalized trace of a polynomial in several independent Haar-distributed random unitary matrices. This result has previously been generalized in two ways: first, to the large N limit of several interacting random matrices (Collins, Guionnet, Maurel-Segala); second, to global fluctuations of several independent random matrices (Mingo, Sniady, Speicher). I will present a unification and extension of these results to the complete asymptotics of all cumulants of several interacting random unitary matrices. The approach rests on the systematic analysis of a hierarchy of noncommutative partial differential equations known as the "Schwinger-Dyson lattice." This is joint work with Alice Guionnet.