Probabilistic Operator Algebra Seminar

Organizer: Dan-Virgil Voiculescu

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Title: *S-transform in finite free probability*

We show a simple way to obtain a limiting spectral distribution of a sequence of polynomials (with increasing degree) directly using their coefficients. Specifically, we relate the asymptotic behaviour of the ratio of consecutive coefficients to Voiculescu's S-transform of the limiting measure. In the framework of finite free probability, this ratios of coefficients can be understood as a new notion of finite S-transform, which converges to Voiculescu's S-transform. It also satisfies several analogous properties to those of the S-transform in free probability, including multiplicativity and monotonicity. We will mention some of the main ingredients of the proof that include topics of independent interest such as partial order in the set of polynomials, and a simplified explanation of why free fractional convolution corresponds to the differentiation of polynomials. Finally we will review some of the many applications: generalize the approximation of $\boxtimes_d$ to $\boxtimes$; prove a finite approximation of the Tucci-Haagerup-Moller limit theorem in free probability; and compute the limiting S-transform of hypergeometric polynomials (that include Laguerre and Jacobi). Based on joint work with Octavio Arizmendi, Katsunori Fujie and Yuki Ueda (arXiv:2408.09337).