Workshop on Non-commutative Probability

We plan to run the workshop on non-commutative probability in hybrid form.

- Organizers: Benoît Collins (Kyoto University), Narutaka Ozawa (Kyoto University), Noriyoshi Sakuma (Nagoya City University)

- Dates: from 22nd June to 24th, 2022

- Type: Hybrid(in-person and zoom)

- Venue: RIMS room 110 (Access: `https://www.kurims.kyoto-u.ac.jp/en/access-01.html`)

- Schedule:

	22nd	23rd	24th
10:00–11:30	Srivastava	Srivastava	Srivastava
13:30-14:15	Liang	Ueda	Sheng
14:30-15:15	Yuan	Fujie	

- Registration and entry information: see google form: `https://forms.gle/mBqz2Q63X3z68daz5`
  Deadline: 16th June

  Due to limited in-person participation, priority will be given to speakers, local residents, and early registrants.

- This workshop is partially supported by JSPS Kakenhi 20K20882, 21H00987, 19K03515.

Abstracts

- Nikhil Srivastava (UC Berkeley)

  Title: Finite Free Probability, Ramanujan Graphs, and the Geometry of Polynomials

  Abstract: Free Probability is a branch of operator algebras which among other things allows one to exactly calculate the limiting distributions of certain unitarily invariant random matrix models. Ramanujan graphs are sparse finite graphs with a spectral gap that is as large as possible. Geometry of Polynomials is a classical area which studies, among other things, the dynamics of roots of univariate polynomials under differential operators. In this series of lectures I will introduce the nascent theory of finite free probability, which connects these three subjects via a study of the expected characteristic polynomials of the adjacency matrices of random regular graphs. The presentation will be entirely self contained with a focus on directions for future research.

- Katsunori Fujie (Hokkaido Univesity)

  Title: The spectra of principal submatrices in unitarily invariant hermitian random matrices

  Abstract: In this talk, we observe a concentration phenomenon on the empirical eigenvalue distribution (EED) of the principal submatrix in a random hermitian matrix whose distribution is invariant under unitary conjugacy; for example, this class includes GUE (Gaussian Unitary Ensemble) and Wishart matrices. More precisely, if the EED of the whole matrix converges to some deterministic probability measure m, then the difference of rescaled EEDs of the whole matrix and of its principal submatrix concentrates at the Rayleigh measure (in general, a Schwartz distribution) associated with m by the Markov–Krein correspondence. This talk is based on joint works with Takahiro Hasebe in Hokkaido university.

- Yuki Ueda (Hokkaido University of Education)

  Title: The class of freely quasi-infinitely divisible distributions and an extension of Bercovici-Pata bijection

Abstract: Bożejko raised a question whether the Bercovici-Pata bijection which is a bijection between two classes of classically and free infinitely divisible distributions can be extended to an wider domain than the class of infinitely divisible distributions. We investigate the class of (classically or freely) quasi-infinitely divisible distributions to answer the question affirmatively. More strictly, we find the common characteristic triplets of classically and freely quasi-infinitely divisible distributions appeared from the Lévy-Khintchine type representation. This is a joint-work of Ikkei Hotta, Wojciech Młotkowski and Noriyoshi Sakuma.

- Sheng Yin (Kyoto University)

  Title: A finite de Finetti theorem for the unitary dual group

  Abstract: The classical de Finetti theorem addresses the relation between the symmetry and the independence for an infinite sequence of random variables. For finite many random variables with certain symmetric distribution, it is known that above relation holds in some sense of approximation. In free proabability, de Finetti type theorem of infinitely many random variables has been studied under various settings. In this talk, we will present a joint work (in progress) with Guillaume Cébron and Max Fathi that investigates a finite de Finetti theorem analogue to a classical counterpart due to Meckes. For that purpose, we apply the free Stein method to non-commutative random variables that are invariant under the action of the unitary dual group.

- Wangjun Yuan(University of Ottawa)

  Title: On spectral distribution of sample covariance matrices from large dimensional and large k-fold tensor products

  Abstract: We study the eigenvalue distributions for sums of independent rank-one k-fold tensor products of large n-dimensional vectors. Previous results in the literature assume that $k = o(n)$ and show that the eigenvalue distributions converge to the celebrated Marčenko-Pastur law under appropriate moment conditions on the base vectors. In this paper, motivated by quantum information theory, we study the regime where k grows faster, namely $k = O(n)$. We show that the moment sequences of the eigenvalue distributions have a limit, which is different from the Marčenko-Pastur law. As a byproduct, we show that the Marčenko-Pastur law limit holds if and only if $k = o(n)$ for this tensor model. The approach is based on the method of moments. This is a joint work with Benoit Collins and Jianfeng Yao.

- Liang Zhao (Harbin Institute of Technology)

  Title: The Spectrum of Local Random Hamiltonians

  Abstract: The spectrum of local random Hamiltonian can be represented generically by the so-called ε-free convolution of its local terms probability distributions. To this end, I will introduce an isomorphism between the set of ε-noncrossing partitions and permutations. Moreover, some lower and upper bounds for the maximal eigenvalue have been derived.