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Plenary Talk
Contributed Talk

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Arrival	8:45~9:00 Registration & Opening					~14:00 Departure
	9:00~9:45 Accardi	9:00~9:45 Speicher	9:00~9:45 Voiculescu	9:00~9:45 Hida	9:00~9:45 Sinha	
	9:45~10:00 Break					
	10:00~10:30 Kye	10:00~10:30 Yoshida	10:00~10:45 Obata	10:00~10:30 Wysoczanska-Kula	10:00~10:30 Quezada	
	10:30~11:00 Watanabe	10:30~11:00 Mukhamedov		10:30~11:00 Wysoczanski	10:30~11:00 Lee (Hun Hee)	
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	11:10~11:55 Fagnola	11:10~11:55 Belinschi		11:10~11:55 Rebolledo	11:10~11:55 Fidaleo	
	11:55~13:30 Lunch			11:55~13:30 Lunch		
	13:30~14:15 Bhat	13:30~14:15 Pechen		13:30~14:15 Goswami	13:30~14:15 Ji	
	14:15~14:30 Break			14:15~14:30 Break		
	14:30~15:00 Matsuoka	14:30~15:00 Krystek		14:30~15:00 Lim	14:30~15:00 Arizmendi	
	15:00~15:30 Crismale	15:00~15:30 Wojakowski		15:00~15:30 Lee (Hyun Ho)	15:00~15:30 Gerhold	
	15:30~15:40 Break		11:40~ Excursion	15:30~15:40 Break		
	15:40~16:10 Lytvynov	15:40~16:10 Gnacik		15:40~16:10 Asai	15:40~16:10 Lachs	
	16:10~16:40 Jenčová	16:10~16:40 Sifi		16:10~16:40 Moskovich	16:10~16:40 Gomis	
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19:30~ Welcome Dinner	18:00~ Dinner	18:00~ Banquet		18:00~ Dinner	18:00~ Dinner	

Program

August 21 (Thursday)

19:30∼ **Welcome Dinner**

August 22 (Friday)

08:45 – 09:00 **Registration & Opening**

09:00 – 09:45 **Luigi Accardi (University of Roma Tor Vergata, Italy)**

TBA

09:45 – 10:00 **Break**

10:00 – 10:30 **Seung-Hyeok Kye (Seoul National University, Korea)**

Permanents of matrices arising from quantum information theory

10:30 – 11:00 **Noboru Watanabe (Tokyo University of Science, Japan)**

Note on entropies of quantum compound systems

11:00 – 11:10 **Break**

11:10 – 11:55 **Franco Fagnola (Politecnico di Milano, Italy)**

Structure of norm-continuous quantum Markov semigroups

11:55 – 13:30 **Lunch**

13:30 – 14:15 **B. V. Rajarama Bhat (Indian Statistical Institute, Bangalore, India)**

Pure semigroups of isometries on Hilbert C^*-modules

14:15 – 14:30 **Break**

14:30 – 15:00 **Takashi Matsuoka (Tokyo University of Science, Suwa, Japan)**

Generalized quantum encoding and its capacity

15:00 – 15:30 **Vitonofrio Crismale (University of Bari, Italy)**

Symmetric states on some C^*-algebras

15:30 – 15:40 **Break**

15:40 – 16:10 **Eugene Lytvynov (Swansea University, United Kingdom)**

Noncommutative Meixner-type orthogonal polynomials for anyone statistics

16:10 – 16:40 **Anna Jenčová (Mathematical Institute, Slovak Academy of Sciences, Slovakia)**

Distinguishability norms in quantum information theory

16:40 – 17:00 **Break**

17:00 – 17:30 **Adam Paszkiewicz (University of Lodz, Poland)**

The world of projections in Hilbert spaces and in operator algebras

18:00 $\sim$ **Dinner**

August 23 (Saturday)

09:00 – 09:45 **Roland Speicher (Saarland University, Germany)**

Absence of algebraic relations and of zero divisors under the assumption of finite non-microstates free Fisher information

09:45 – 10:00 **Break**

10:00 – 10:30 **Hiroaki Yoshida (Ochanomizu University, Japan)**

On limit distributions and fluctuations of Marchenko-Pastur limit of random matrices with dependent entries

10:30 – 11:00 **Farrukh Mukhamedov (International Islamic University Malaysia, Malaysia)**

Quantum Phase transition for Ising type models on a Cayley tree of order two

11:00 – 11:10 **Break**

11:10 – 11:55 **Serban Belinschi (CNRS - Institut de Mathematiques de Toulouse, France and Queen's University, Canada)**

Outliers in the spectrum of deformed unitarily invariant matrix models

11:55 – 13:30 **Lunch**

13:30 – 14:15 **Alexander Pechen (Steklov Mathematical Institute, Russia)**

Recent progress in the analysis of quantum control landscapes

14:15 – 14:30 **Break**

14:30 – 15:00 **Anna Krystek (University of Wrocław, Poland)**

Bargmann measures for t–deformed probability

15:00 – 15:30 **Łukasz Wojakowski (University of Wrocław, Poland)**

Direct products of automorphism groups of digraphs

15:30 – 15:40 **Break**

15:40 – 16:10 **Michal Gnacik (Lancaster University, United Kingdom)**

Quantum random walk approximation to quasifree cocycles

16:10 – 16:40 **Mohamed Sifi (Faculty of Sciences of Tunis, Tunisia)**

Survival time of a heterogeneous random walk in a quadrant

16:40 – 17:10 **Seonguk Yoo (Seoul National University, Korea)**

Truncated moment problems with conic or cubic column relations

17:10 – 17:20 **Break**

17:20 – 18:00 **QP Meeting**

18:00 $\sim$ **Banquet**

August 24 (Sunday)

09:00 – 09:45 **Dan-Virgil Voiculescu (UC Berkeley, USA)**

Free Probability for Pairs of Faces

09:45 – 10:00 **Break**

10:00 – 10:45 **Nobuaki Obata (Tohoku University, Japan)**

Transforms in quantum white noise calculus

10:45 – 11:15 **Mithun Mukherjee (IISER Kolkata, India)**

Amalgamated product of product systems through contractive units

11:40 $\sim$ **Excursion**

August 25 (Monday)

09:00 – 09:45 **Takeyuki Hida (Nagoya University, Japan)**

Roles of the multiplicity in stochastic analysis and the multiple Markov properties of Gaussian processes

09:45 – 10:00 **Break**

10:00 – 10:30 **Anna Wysoczańska-Kula (University of Wrocław, Poland)**

Hunt's formula for the quantum $SU_q(N)$

10:30 – 11:00 **Janusz Wysoczanski (University of Wrocław, Poland)**

Generalized t***-transformation of measures and operators***

11:00 – 11:10 **Break**

11:10 – 11:55 **Rolando Rebolledo (Universidad Católica de Chile, Chile)**

Directed entangled states and reversibility

11:55 – 13:30 **Lunch**

13:30 – 14:15 **Debashish Goswami (Indian Statistical Institute, India)**

Quantum group actions on classical and noncommutative manifolds

14:15 – 14:30 **Break**

14:30 – 15:00 **Yongdo Lim (Sungkyungkwan University, Korea)**

Monotonicity of the Karcher Mean

15:00 – 15:30 **Hyun Ho Lee (University of Ulsan, Korea)**

On noncommutative sigma model

15:30 – 15:40 **Break**

15:40 – 16:10 **Nobuhiro Asai (Aichi University of Education, Japan)**

The Boas-Buck's problem and related topics to classical and quantum orthogonal polynomials

16:10 – 16:40 **Daniel Moskovich (Nanyang Technologica University, Singapore)**

A geometric topological picture for adiabatic quantum computation

16:40 – 17:00 **Break**

17:00 – 17:30 **Yong Sul Won (Imperial College London, United Kingdom)**

Smoothing properties of infinite dissipative systems

17:30 – 18:00 **Yuchen Pei (Warwick University, United Kingdom)**

Approximating a causal double product integral using the Catalan numbers

18:00 $\sim$ **Dinner**

August 26 (Tuesday)

09:00 – 09:45 **Kalyan B. Sinha (Center for Advanced Scientific Research, India)**

Brownian bridge in quantum probability

09:45 – 10:00 **Break**

10:00 – 10:30 **Roberto Quezada (Universidad Autonoma Metropolitana, Iztapalapa Campus, Mexico City, Mexico)**

On the structure of a class of GKSL generators that admit non-equilibrium steady states

10:30 – 11:00 **Hun Hee Lee (Seoul National University, Korea)**

Weighted Fourier algebras of compact quantum groups: characters and finite dimensional representations

11:00 – 11:10 **Break**

11:10 – 11:55 **Francesco Fidaleo (University of Tor Vergata, Italy)**

The condensation of Bosons and q-particles in equilibrium and non equilibrium thermodynamics, A New Approach

11:55 – 13:30 **Lunch**

13:30 – 14:15 **Un Cig Ji (Chungbuk National University, Korea)**

Implementation problem and quantum Girsanov theorem

14:15 – 14:30 **Break**

14:30 – 15:00 **Octavio Arizmendi (CIMAT)**

Relations between cumulants in non-commutative probability

15:00 – 15:30 **Malte Gerhold (University of Greifswald, Germany)**

Dimension of continuous-time subproduct systems

15:30 – 15:40 **Break**

15:40 – 16:10 **Stephanie Lachs (University of Greifswald, Germany)**

Classification of non-positive universal products

16:10 – 16:40 **Antoine Gomis (BHT)**

On Riemann Zeta-function, hypothesis and quantum gravity

16:40 – 17:10 **Byoung Jin Choi (Hanyang University, Korea)**

Law of large numbers for weighted inductive means in Hadamard space

18:00 $\sim$ **Dinner**

Abstract

- **Luigi Accardi (Universit di Roma Tor Vergata, Italy)**
  TBA

  TBA

- **Octavio Arizmendi (CIMAT)**

  Relations between cumulants in non-commutative probability

  Cumulants provide a combinatorial description of independence of random variables. In this talk I will explain recent work with Hasebe, Lehner and Vargas where we complete for the relations between classical, free, Boolean and monotone cumulants.

- **Nobuhiro Asai (Aichi University of Education, Japan)**

  The Boas-Buck's problem and related topics to classical and quantum orthogonal polynomials

  In the first part, I will give a histrical survey on the long-standing open problem, the so-called Boas-Buck problem on orthogonal polynomials. In the second part, I will treat some of my recent interest related to classical and quantum orthogonal polynomials obtained from the Boas-Buck type generating functions.

- **Serban Belinschi (CNRS - Institut de Mathematiques de Toulouse, France and Queen's University, Canada)**

  Outliers in the spectrum of deformed unitarily invariant matrix models

  We consider matrix models of the type $A_N + U_N^* B_N U_N$ and $A_N U_N^* B_N U_N$, where A_N and B_N are deterministic matrices and U_N is a Haar-distributed random unitary. When A_N, B_N are Hermitian, respectively positive or unitary, and their asymptotic (as $N \to \infty$) eigenvalue distributions are known, a fundamental result of Voiculescu specifies the asymptotic eigenvalue distributions for the models we consider. However, this result by necessity will not apply to the study of the behaviour of a vanishingly small (as $N \to \infty$) proportion of eigenvalues with possibly abnormal behaviour (the "outliers") from the spectrum of the deformed models. In this talk we will show how Voiculescu's tools, together with some concentration of measure results and matrix functions techniques, can be adapted to provide a complete asymptotic analysis of these outliers and of their associated eigenvectors. This is joint work with H. Bercovici, M. Capitaine and M. Fevrier.

- **B. V. Rajarama Bhat (Indian Statistical Institute, Bangalore, India)**

  Pure semigroups of isometries on Hilbert C^*-modules

  We characterize pure one parameter semigroups of adjointable isometries on Hilbert C^*-modules. This is a joint work with Michael Skeide.

- **Byoung Jin Choi (Hanyang University, Korea)**

Law of large numbers for weighted inductive means in Hadamard space

The law of large numbers (LLN) plays an important role in probability theory, which is concerned with the convergence of $(S_n - b_n)/n$, where $S_n = \sum_{i=1}^{n} X_i$ and $\{b_n\}$ is a sequence of real numbers. In fact, if $(S_n - b_n)/n$ converges almost surely to zero, then the convergence theorem is called the strong law of large numbers (SLLN), and if $(S_n - b_n)/n$ converges in probability (measure) to zero, then the convergence theorem is referred to the weak law of large numbers (WLLN).

Let $\{X_i\}$ be a sequence of independent identically distributed Hadamard space valued random variables and $\{a_{ni}\}$ be a positive weighted sequence with $\sum_{i=1}^{n} a_{ni} = 1$ for $n \in \mathbb{N}$. Given the positive weighted sequence $\{a_{ni}\}$, we define a new weighted sequence $\{y_{(n-k)i}\}$, for $k = 1, 2, \cdots, n-1$, by induction on k as follows:

$$y_{(n-1)i} := \frac{a_{ni}}{1 - a_{nn}} \quad \text{for all} \quad i = 1, 2, \cdots, n-1 \quad \text{and}$$
$$y_{(n-k)i} := \frac{y_{(n-k+1)i}}{1 - y_{(n-k+1)(n-k+1)}} \quad \text{for all} \quad i = 1, 2, \cdots, n-k,\ k = 2, 3, \cdots, n-1,$$

Now, given the sequence $\{X_i\}$ and positive weighted sequence $\{a_{ni}\}$, we define a new sequence $\{S_n\}$, which called a weighted inductive mean (or weighted sum), by induction on n as follows:

$$S_1 = X_1 \quad \text{and} \quad S_n = Y_{n-1} \#_{a_{nn}} X_n,\ n \geq 2 \tag{1}$$

where $Y_1 = X_1$, $Y_{n-k} := Y_{n-(k+1)} \#_{y_{(n-k)(n-k)}} X_{n-k}$ for $k = 1, 2, \cdots, n-2$, and $A \#_t B$ is the t-weighted geometric mean i.e., the point $p(t)$ on the geodesic $p : [0, 1] \longrightarrow N$ connecting $p(0) = A$ and $p(1) = B$.

In this talk, we study the law of large numbers for weighted inductive means of Hadamard space valued random variables with a positive weighted sequence.

This is a joint work with Jaeseong Heo and Un Cig Ji.

- **Vitonofrio Crismale (University of Bari, Italy)**

Symmetric states on some C^*-algebras

A state on a C^*-algebra is symmetric when it is invariant under the action of the group of permutations.

We show there is a one–to–one correspondence between quantum stochastic processes, either preserving or not the identity, and states on free product C^* - algebras, unital or not unital respectively, where the exchangeable ones correspond precisely to the symmetric states. In the talk we also present a connection between some algebraic properties of exchangeable processes, that is the fact that they satisfy the product state or the block–singleton conditions, to some natural ergodic ones.

Moreover De Finetti-type results will be shown for the C^* - algebras generated by the Fock representation of the q-commutation relations ($|q| < 1$), the CAR algebra and the C^* - algebra generated by Boolean Commutation Relations.

The results are obtained jointly with F. Fidaleo.

- **Franco Fagnola (Politecnico di Milano, Italy)**

Structure of norm-continuous quantum Markov semigroups

The structure of norm-continuous quantum Markov semigroups with atomic decoherence-free subalgebra is established providing a natural decomposition of a Markovian quantum open system into its irreducible and noiseless components. This leads to new characterisations of the structure of invariant states and decoherence free subsystems.

- **Francesco Fidaleo (University of Tor Vergata, Italy)**

  The condensation of bosons and q-particles in equilibrium and non equilibrium thermodynamics, A New Approach

  We discuss new stationary equilibrium and non equilibrium states exhibiting condensation of q–particles, $q \in [-1, 1]$, where the condensation can occur only if $0 < q \leq 1$. The case Bose/Fermi alternative are obtained as particular cases corresponding to the values of $q = \pm 1$, where $q = 1$ corresponds to the standard Bose–Einstein condensation. Unexpected facts are that states describing inhomogeneous distribution of the condensate, and/or condensation on excited levels can naturally occur. Such new examples of Non Equilibrium Steady States might find natural applications in cosmology, whereas the completely new equilibrium states we found, present promising analogies with the physics of the rotating superfluids.

  At least in the 2^{nd} quantisation setting of free particles, we propose a new approach (which might be extended to more general situations) naturally based on the theory of the Distributions. (joint work with L. Accardi)

- **Malte Gerhold (University of Greifswald, Germany)**

  Dimension of continuous-time subproduct systems

  A subproduct system is a family of Hilbert spaces indexed by the nonnegative integers (discrete case) or the nonnegative reals (continuous-time case) s.t. the Hilbert spaces to parameter s+t are embedded into the tensor products of those for s and t in an associative way. The prefix "sub" refers to the fact that the embeddings are only isometries, not necessarily unitaries. Submultiplicativity is an obvious restriction concerning the possible dimensions of subproduct systems, but already in the discrete case not every submultiplicative sequence arises as dimension sequence of a subproduct system. We review some results about the discrete case, and apply them to find criteria for an integer valued function to be the dimension function of a continuous-time subproduct system.

- **Michal Gnacik (Lancaster University, United Kingdom)**

  Quantum random walk approximation to quasifree cocycles

  We discuss the model of repeated quantum interactions between an open quantum system S and its environment B, modelled by an infinite chain of identical particles. The continuous-time limit of the associated discrete-time unitary evolution of $S + B$ forms a unitary quantum stochastic cocycle. When B is considered to be an infinite chain of particles such that each particle is in a normal faithful state ρ, the limit cocycles are strictly quasifree, thus the driving noises form a type III representation of the relevant CCR algebra. These representations induce gauge-invariant and squeezed quasifree states. We also discuss a non-interacting bipartite quantum system which are coupled to the environment B, represented by an infinite chain of identical particles. (Based on joint work with Alexander Belton and Martin Lindsay.)

- **Antoine Gomis (BHT)**

  On Riemann Zeta-function, hypothesis and quantum gravity

  The connection between the Riemann Hypothesis and a Theory of Quantum Gravity will be outlined and developed.

- **Debashish Goswami (Indian Statistical Institute, India)**

  Quantum group actions on classical and noncommutative manifolds

I'll discuss the concept of a smooth action of a compact quantum group on a compact manifold and present the recent results obtained by me with Das and Joardar that any compact quantum group which admits a faithful smooth action on a compact connected smooth manifold must be $C(G)$ for some group G, i.e. not a genuine quantum group. I'll discuss the ideas of proof and several applications and related results. If time permits, I'll discuss little bit about the quantum isometry group of metric spaces too.

- **Takeyuki Hida (Nagoya University, Japan)**

  Roles of the multiplicity in stochastic analysis and the multiple Markov properties of Gaussian processes

  Let $X(\xi), \xi \in E$ be a generalized stochastic process, often called a random distribution. We shall assume the existence of variance, so that we can find a Hilbert space $\mathbf{H}$ generated by the $X(\xi)$. By using the structure of the Hilbert space $\mathbf{H}$ we shall discuss dependencies of generalized stochastic processes $X(\xi)$ in two ways. Assuming some analytic properties and others we can see that there exists the resolution $\{E(t), t \in R^1\}$ of the identity I, where each $E(t)$ corresponds to the conditional expectation relative to the events up to time t. We can now appeal to the Stone-Hellinger-Hahn Theorem to have the decomposition of $\mathbf{H}$ into cyclic subspaces as many as N. The number N is the *multiplicity* of the $X(\xi)$ and it may be thought of as a quantity describing the **complexity of randomness** of the $X(\xi)$. This is the first step to consider the dependence of the $X(\xi)$'s.

  The second step is concerned with the multiple Markov properties in the weak sense of the a single cyclic subspace. These properties can be defined again by using the projections.

  In case $X(\xi)$ is Gaussian, we can define just a multiple Markov property, and give it the representation explicitly in terms of white noise. There are given much finer, indeed good probabilistic expressions. Needless to say, we can further see profound stochastic structures of the $X(\xi)$ in question.
  Note. Part of this report is a joint work with Si Si.

- **Anna Jenčová (Mathematical Institute, Slovak Academy of Sciences, Slovakia)**

  Distinguishability norms in quantum information theory

  We introduce a family of norms, which we call base section norms, in finite dimensional matrix ordered vector spaces. These norms give minimum Bayes errors in the problem of discrimination of quantum protocols. Special cases of base section norms include the trace norm, diamond norm and the conditional min-entropy. Moreover, we define general quantum decision problems and prove that the risk functions are also given by base section norms.

- **Un Cig Ji (Chungbuk National University, Korea)**

  Implementation problem and quantum Girsanov theorem

  The quantum extension of Girsanov theorem is formulated as an implementation problem which is represented by the Wick type differential equations associated with the quantum white noise derivatives. By solving the differential equations associated with the quantum white noise derivatives, we study the quantum extension of Girsanov theorem.

- **Anna Krystek (University of Wrocław, Poland)**

  Bargmann measures for $t-$deformed probability

  V. Bargmann showed that there is a unitary isomorphism from the Hilbert space $L^2(\mathbb{R}^n, \frac{1}{\sqrt{(2\pi)^n}}$

$e^{-\frac{\|x\|^2}{2}}\mathrm{d}x$) with the usual scalar product onto the Hilbert space of all holomorphic functions in n complex variables, equipped with the scalar product

$$\langle f, g\rangle = \int_{\mathbb{C}^n} f(z)\overline{g(z)}\mathrm{d}\gamma_n(z),$$

where $\mathrm{d}\gamma_n(z) = \pi^{-n}e^{-\|z\|^2}\mathrm{d}z$ for $z \in \mathbb{C}^n$, that maps orthogonal polynomials of the first space onto monomials of the same degree in the second. That mapping is usually called the Segal–Bargmann transform. A similar result was shown by Asai, Kubo and Kuo for the Gaussian and Poisson measures. It is therefore natural to ask if the Segal–Bargmann transform will have the desired properties for Hilbert spaces constructed with other measures on $\mathbb{R}$. A necessary condition for that is the existence of an analogue of the measure γ_n as a solution to a complex moment problem depending on the initial measure. We are studying some general facts about such moment problems, and calculating a few examples for central limit measures of convolutions appearing around the free probability theory.

- **Seung-Hyeok Kye (Seoul National University, Korea)**

  Permanents of matrices arising from quantum information theory

  One of the most important problems in quantum information theory is to determine if a given state is separable or entangled. The PPT criterion by Choi in 1980 is quite strong for this purpose, and was rediscovered by Peres in the nineties. But, it is very difficult in general to determine if a given PPT state is separable or not. The range criterion is quite useful for this purpose. In order to apply the range criterion, we have to consider algebraic equations in terms of complex variables and their conjugates. Existences and numbers of solutions naturally depend on the numbers of equations and variables, and it is very subtle to determine the existence in the critical case when two numbers coincide. In the multi-qubit cases, we show that the existence of a solution depends on the permanent of the associated matrix, which has been studied from the era of Cauchy. This talk will be based on a co-work with Y.-H. Kiem and J. Na [arXiv 1401.3181]

- **Stephanie Lachs (University of Greifswald, Germany)**

  Classification of non-positive universal products

  Muraki has classified universal products which are normalized on Elements of length 2, or equivalently all positive universal products [1]. Ben Ghorbal and Sch?mann classified commutative universal products in [2]. In this talk, we classify all universal products without any restriction on length 2 or positivity assumptions and without assuming commutativity. We present a new family of universal products which form a two parameter deformation of the Boolean product. As an application we calculate the moments of the central limit distributions, which are closely related to the Eulerian numbers.

References

[1] N. Muraki, *The five independences as natural products,* Infin. Dimens. Anal. Quanum Probab. Relat. Top. **6** (2003), no. 3, 337–371.

[2] A. Ben Ghorbal and M. Schümann, *Non-commutative notions of stochastic independence,* Math. Proc. Cambridge Philos. Soc. **133** (2002), no.3, 531–561.

- **Hun Hee Lee (Seoul National University, Korea)**

  Weighted Fourier algebras of compact quantum groups: characters and finite dimensional representations

  In this talk we will discuss about weighted algebras related to compact quantum group aiming for detecting the structure of the underlying quantum group via its "complexification". In the classical case the commutative algebra called Fourier algebra can detect the group itself as its Banach algebra spectrum. Moreover, the process of making it weighted allows us to see the points of the complexification of the underlying group. We will continue this line of attempts in two ways, namely via characters and finite dimensional representations. This is a joint work with Uwe Franz.

- **Hyun Ho Lee (University of Ulsan, Korea)**

  On noncommutative sigma model

  We review the unified approach on noncommutative sigma model by Mathai and Rosenberg. We present a recent progress on searching harmonic unitaries.

- **Yongdo Lim (Sungkyungkwan University, Korea)**

  Monotonicity of the Karcher Mean

  The Karcher or least squares mean has recently become an important tool for the averaging and study of positive definite operators. The important question of the monotonicity (multivariable Loewner-Heinz inequality) of this mean, conjectured by Bhatia and Holbrook, has been solved by using the theory of nonpositively curved metric space, techniques from probability and random variable theory, non-linear operator equations, operator power means, and proximal point algorithms. We present an overview of these recent works in the development of multivariable operator geometric means.

- **Eugene Lytvynov (Swansea University, United Kingdom)**

  Noncommutative Meixner-type orthogonal polynomials for anyone statistics

  Let ν be a finite measure on $\mathbb{R}$ whose Laplace transform is analytic in a neighborhood of zero. An anyon Lévy process on $(\mathbb{R}^d, dx)$ is a certain family of noncommuting operators $\langle \varphi, \omega \rangle$ in the anyon Fock space over $L^2(\mathbb{R}^d \times \mathbb{R}, dx \otimes \nu)$. Here $\varphi = \varphi(x)$ runs over a space of test functions on $\mathbb{R}^d$, while $\omega = \omega(x)$ is interpreted as an operator-valued distribution on $\mathbb{R}^d$. Let $L^2(\tau)$ be the noncommutative L^2-space generated by the algebra of polynomials in variables $\langle \varphi, \omega \rangle$, where τ is the expectation at the vacuum state. We construct noncommutative orthogonal polynomials in $L^2(\tau)$ of the form $\langle f^{(n)}, P_n(\omega) \rangle$, where $f^{(n)}$ is a test function on $(\mathbb{R}^d)^n$. Using these orthogonal polynomials, we derive a unitary isomorphism U between $L^2(\tau)$ and an extended anyon Fock space over $L^2(\mathbb{R}^d, dx)$, denoted by $\mathbf{F}(L^2(\mathbb{R}^d, dx))$. The usual anyon Fock space over $L^2(\mathbb{R}^d, dx)$, denoted by $\mathcal{F}(L^2(\mathbb{R}^d, dx))$, is a subspace of $\mathbf{F}(L^2(\mathbb{R}^d, dx))$. Furthermore, we have the equality $\mathbf{F}(L^2(\mathbb{R}^d, dx)) = \mathcal{F}(L^2(\mathbb{R}^d, dx))$ if and only if the measure ν is concentrated at one point, i.e., in the Gaussian/Poisson case. Using the unitary isomorphism U, we realize the operators $\langle \varphi, \omega \rangle$ as a Jacobi (i.e., three-diagonal) field in $\mathbf{F}(L^2(\mathbb{R}^d, dx))$. We derive a Meixner-type class of anyon Lévy processes for which the respective Jacobi field in $\mathbf{F}(L^2(\mathbb{R}^d, dx))$ has a relatively simple structure. Each anyon Lévy process of the Meixner type is characterized by two parameters: $\lambda \in \mathbb{R}$ and $\eta \geq 0$. Furthermore, we get the representation $\omega(x) = \partial_x^\dagger + \lambda \partial_x^\dagger \partial_x + \eta \partial_x^\dagger \partial_x \partial_x + \partial_x$. Here ∂_x and $\partial_x^\dagger$ are annihilation and creation operators at point x.This is a joint work with Marek Bożejko and Irina Rodionova.

- **Takashi Matsuoka (Tokyo University of Science, Suwa, Japan)**

  Generalized quantum encoding and its capacity

  Quantum correlation called quantum physics entanglements, are used to study the quantum information theory. In this poster we review the algebraic and operational approach to quantum entanglement as generalized encoding given by Belavkin and Ohya. In their scheme classical-quantum correspondences such as quantum encodings can be treated as d (diagonal) - entanglement leading to a special class of separable compound states. The mutual information for the d -compound state and for q (quantum) -compound (entangled) states leads to two types of entropies for a given quantum state. We will discuss the difference of such two types of entropies from the view point of two types of quantum correlations. On the base of above understanding for the mutual information via entanglement the corresponding quantum channel capacity as the supremum via generalized encodings are discussed.

- **Daniel Moskovich (Nanyang Technologica University, Singapore)**

  A geometric topological picture for adiabatic quantum computation

  We define a topologically-inspired equivalence relation on networks of adiabatic quantum computations. Equivalent networks generate the same solutions but with different run times and with different minimal energy gaps. Based on this equivalence relation, our geometric topological picture suggests a scheme for optimizing networks of adiabatic quantum computations. We study this scheme in the context of Grover's algorithm. This is joint work with Avishy Carmi and Tomasz Paterek.

- **Farrukh Mukhamedov (International Islamic University Malaysia, Malaysia)**

  Quantum Phase transition for Ising type models on a Cayley tree of order two

  In this work, we construct a quantum Markov chain (QMC) associated by the classical Ising model with competing interactions on the Cayley tree of order two. In the construction QMC is defined as a weak limit of finite volume states on quasi-local algebras with boundary conditions. We point out that phase transitions in a quantum setting play an important role to understand quantum spin systems We have defined a notion of phase transition in QMC scheme. Namely, such a notion is based on the quasi-equivalence of QMC. Therefore, such a phase transition is purely non-commutative. In this work we establish the existence of the phase transition in the following sense: there exists two quantum Markov states which are not quasi-equivalent. It turns out that the found critical temperature coincides with usual critical temperature.

- **Mithun Mukherjee (IISER Kolkata, India)**

  Amalgamated product of product systems through contractive units

  In [2], amalgamation of two product systems through contractive morphism was introduced. In a special case, when the contractive morphism is implemented by normalized units in respective product systems, it is nothing but the spatial product of product system of Hilbert spaces ([3]). It was shown in [1], that the spatial product of two spatial product systems is independent of the choice of the reference units. Here we show that the amalgamation through contractive units is independent of the choice of the units and moreover the isomorphism class of the amalgamated product splits into two cases depending on whether or not the units are normalized. The amalgamated product in the non-normalized case is isomorphic to the tensor product of the amalgamated product in normalized case and the type I product system of index 1.

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- **Nobuaki Obata (Tohoku University, Japan)**

Transforms in quantum white noise calculus

Transforms in quantum white noise calculus "Quantum white noise calculus provides a framework for the study of operators on (Boson) Fock space, where classical stochastic analysis and quantum theory encounter. Our starting point is that the quantum white noises $\{a_t,\, a_t^*\,;\, t \in T\}$ are formulated as a pair of continuous operators on a suitably chosen nuclear space $\mathcal{W}$ densely and continuously embedded in the Fock space $\Gamma(H)$. It is known that a general white noise operator $\Xi \in \mathcal{L}(\mathcal{W}, \mathcal{W}^*)$ is expressible as a function of quantum white noises (Fock expansion theorem). In this line we have developed the concept of quantum white noise derivatives and the theory of differential equations characterizing white noise operators. In this talk we will discuss some of the recent achievements and questions, and relevant topics in complex white noise.

These works are based on the long-term collaboration with Un Cig Ji (Chungbuk National University, Korea).

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- **Adam Paszkiewicz (University of Lodz, Poland)**

The world of projections in Hilbert spaces and in operator algebras

We present some ultimate solution of Amemiya-Ando problem, of Kwapien problem and of some problems connected with representation of operators with sums and linear combinations of projections.

- **Alexander Pechen (Steklov Mathematical Institute, Russia)**

Recent progress in the analysis of quantum control landscapes

Control of atomic and molecular systems with quantum dynamics attracts nowadays high interest due to rich mathematical theory and multiple existing and prospective applications in physics and chemistry. Mathematical formulation of a quantum control problem includes specification of the system state space, the dynamical equation with admissible controls, and target objective functional. Quantum control problem can be formulated as maximization of the objective functional over admissible controls. Control landscape is the graph of the objective functional and its important points are controls which are local but not global maxima (i.e., traps).

In this talk we will outline recent progress in the important interesting mathematical topic of modern quantum control that is the analysis of traps in quantum control landscapes. We will discuss the discovery of trapping features for a wide class of quantum systems with number of states greater that

two [1] as well as recent proof of absence of traps for two-level systems [2, 3] and for quantum systems with infinite-dimensional Hilbert space, namely, for control of qubit by laser field [2, 3]and control of transmission coefficient of a quantum particle passing through one-dimensional potential whose shape is used as control [4]. All results of a high significance as providing classes of controlled quantum systems with or without trapping features.

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- **Yuchen Pei (Warwick University, United Kingdom)**

Approximating a causal double product integral using the Catalan numbers

We consider the causal double product integral

$$\prod_{a<x<y<b} \left(1 + \frac{i\lambda}{2}(dP(x)dQ(y) - dQ(x)dP(y))\right)$$

where λ is a real parameter and P and Q are the "momentum" and "position" Brownian motions of quantum stochastic calculus, which satisfy the commutation relation

$$[P(s), Q(t)] = -2is \wedge t.$$

We approximate it by the discrete double product

$$\prod_{1\leq j<k\leq n} \left(1 + i\lambda\frac{b-a}{2n}(p_j q_k - q_j p_k)\right)$$

where the $\{(p_j, q_j)\}_{1\leq j\leq n}$ are the normalised increments of P and Q over the subintervals of an n-fold equipartitioning of $[a, b)$. These satisfy the standard canonical commutation relations. By identifying each $p_j q_k - q_j p_k$ as an angular momentum and hence as the infinitesimal generator of rotations, this is approximated in turn by the second quantisation $\Gamma(W_n)$ of a discrete double product W_n of rotations in different planes in the Hilbert space $L^2([a, b))$. W_n and its limit W as $n \to \infty$ can be evaluated as explicit unitary operators by counting generalised Dyck paths using the Catalan numbers, the Catalan triangle and generalisations.

- **Roberto Quezada (Universidad Autonoma Metropolitana, Iztapalapa Campus, Mexico City, Mexico)**

On the structure of a class of GKSL generators that admit non-equilibrium steady states

We shall discuss on the structure of a class of Gorini-Kossakowski-Sudarshan and Lindblad (GKSL) generators that admit non-equilibrium steady states. By means of examples we shall illustrate the notions of interacting graph and ω-paths, for positive Bohr frequencies ω.

- **Rolando Rebolledo (Universidad Católica de Chile, Chile)**

  Directed entangled states and reversibility

  Reversibility of a dynamical system is a subject which has been in discussion since the dawn of thermodynamics. In the first third of the twentieth century, Onsager [9] provided a sound analysis of the concept in physics. The linear response theory summarizes Onsager studies on the relation of reversibility with both, the so called detailed balance conditions and the zero production of entropy. In the theory of stochastic processes, reversibility has been widely studied within the framework of Markov chains and processes. This approach includes the statistical physics analysis of classical open systems. A number of authors (see eg. [7], [8]) have been studying a characterization of quantum reversibility via a system of axioms inspired in Onsager reciprocity relations. In [3], Fagnola and I, we introduced a notion of quantum entropy production by extending the classical Markov process theory and using the notion of quantum detailed balance of [5].

  A crucial aspect in all the above studies of reversibility is the concept of direction of a given evolution. One indeed implicitly assume a representation of what "forward" or "backward" means, before establishing a corresponding notion of equilibrium and reversibility.

  Entanglement will be used in my conference to introduce directions of an evolution described by a Quantum Markov Semigroup (QMS). This idea supports our joint research with Franco Fagnola in [4]. And I will summarize necessary and sufficient conditions for reversibility of an important class of these QMS. This class includes the classical case as well as genuinely non commutative semigroups obtained from weak coupling limits or, more generally, via the stochastic limit procedure introduced in [1].

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- **Mohamed Sifi (Faculty of Sciences of Tunis, Tunisia)**

  Survival time of a heterogeneous random walk in a quadrant

  We obtain upper Gaussian estimates of transition probabilities of inhomogeneous random walks on the positive quadrant. Among the most important steps in our proof are comparison arguments based on discrete variants of the Harnack principle and large deviations estimates.

- **Kalyan B. Sinha (Center for Advanced Scientific Research, India)**

  Brownian bridge in quantum probability

  The Brownian Bridge and its properties are studied in the language of Fock space and Quantum Probability.

- **Roland Speicher (Saarland University, Germany)**

  Absence of algebraic relations and of zero divisors under the assumption of finite non-microstates free Fisher information

  We show that in a tracial and finitely generated W^*-probability space existence of conjugate variables in an appropriate sense excludes algebraic relations for the generators. Moreover, under the assumption of finite non-microstates free Fisher information, we prove that there are no zero divisors in the sense that the product of any noncommutative polynomial in the generators with any element from the von Neumann algebra is zero if and only if at least one of those factors is zero. This is joint work with Tobias Mai and Moritz Weber.

- **Dan-Virgil Voiculescu (UC Berkeley, USA)**

  Free probability for pairs of faces

  The talk will be about the recent extension of free probability to systems with two faces, one face of left variables and another face of right variables.

- **Noboru Watanabe (Tokyo University of Science, Japan)**

  Note on entropies of quantum compound systems

  The quantum mutual entropy with respect to the quantum input state and qquantum channel was introduced by Ohya in 1983. It was defined by using the separable compound state between the quantum input and output systems.

  In this talk, we will explain a property of marginal states for the quantum compound states. We will compair with some mutual entropies and show some results for the dynamical systems.

- **Łukasz Wojakowski (University of Wrocław, Poland)**

  Direct products of automorphism groups of digraphs

  We study the direct product of automorphism groups of digraphs. We show that, except for the infinite family of permutation groups $S_n \times S_n$, $n \geq 2$ and four other permutation groups $D_4 \times S_2$, $D_4 \times D_4$, $S_4 \times S_2 \times S_2$, and $C_3 \times C_3$, the direct product of automorphism groups of two digraphs is itself the automorphism group of a digraph.

- **Yong Sul Won (Imperial College London, United Kingdom)**

  Smoothing properties of infinite dissipative systems

  We consider an elliptic type generator defined on a countable product of spheres with an interaction of finite range. In particular, we discuss smoothing properties of the Markov semi-group corresponding to the above diffusion generator in short-term behaviours, which is done through strong estimates on the gradients of operators with suitable choices of constants. Using this approach, we can also construct infinite dimensional diffusion semi-groups for which the equilibrium measures are not a priori known.

- **Anna Wysoczańska-Kula (University of Wrocław, Poland)**

  Hunt's formula for the quantum $SU_q(N)$

  Hunt's formula provides a classification of convolution semigroups of probability measures, or equivalently, of Lévy processes on Lie groups in terms of their genererator. It shows how such processes are combinations of a continuous (or Gaussian) part and a jump part. Since 1998, it is known that an analoguous decomposition into 'Gaussian' and the remaining part is also true for generators of Lévy processes on $SU_q(2)$. Here, the definition of Gaussian processes is the one by M. Schürmann, in the framework of bialgebras. We shall generalize this result to the compact quantum groups $SU_q(N)$, $N \geq 2$. This is the joint work with Uwe Franz, Martin Lindsay, and Michael Skeide.

- **Janusz Wysoczanski (University of Wrocław, Poland)**

  Generalized t***-transformation of measures and operators***

  The t-transformation of measures has been originally defined for probability measures. In this talk we shall present the corresponding version for self-adjoint operators, defined as a parametrized 2-dimensional perturbation. In fact, a related generalization of the original t-transformation of probability measures will be also discussed.

  The talk is based on joint work with Michał Wojtylak (Kraków) and Anna Wysoczańska-Kula (Kraków & Wrocław).

- **Seonguk Yoo (Seoul National University, Korea)**

  Truncated moment problems with conic or cubic column relations

  Inverse problems naturally occur in many branches of science and mathematics. An inverse problem entails finding the values of one or more parameters using the values obtained from observed data.

  Moment problems are a special class of inverse problems. While the classical theory of moments dates back to the beginning of the 20th century, the systematic study of truncated moment problems began only 20 years ago.

  Explicitly, consider a doubly indexed finite sequence of real numbers, *truncated real moment sequence* (of order $2n$), $\beta \equiv \beta^{(2n)}=\{\beta_{00}, \beta_{10}, \beta_{01}, \cdots, \beta_{2n,0}, \beta_{2n-1,1}, \cdots, \beta_{1,2n-1}, \beta_{0,2n}\}$; the truncated real moment problem is to find a positive Borel measure μ supported in the real plane $\mathbb{R}^2$ such that $\beta_{ij} = \int x^i y^j \, d\mu \, , (i,j \in \mathbb{Z}_+, \; 0 \leq i+j \leq 2n)$. The measure μ is referred to as a *representing measure* for β.

  In this talk, we will survey the elementary theory of truncated moment problems, and then focus on the quartic ($n = 2$) and sextic ($n = 3$) moment problems.

- **Hiroaki Yoshida (Ochanomizu University, Japan)**

  On limit distributions and fluctuations of Marchenko-Pastur limit of random matrices with dependent entries

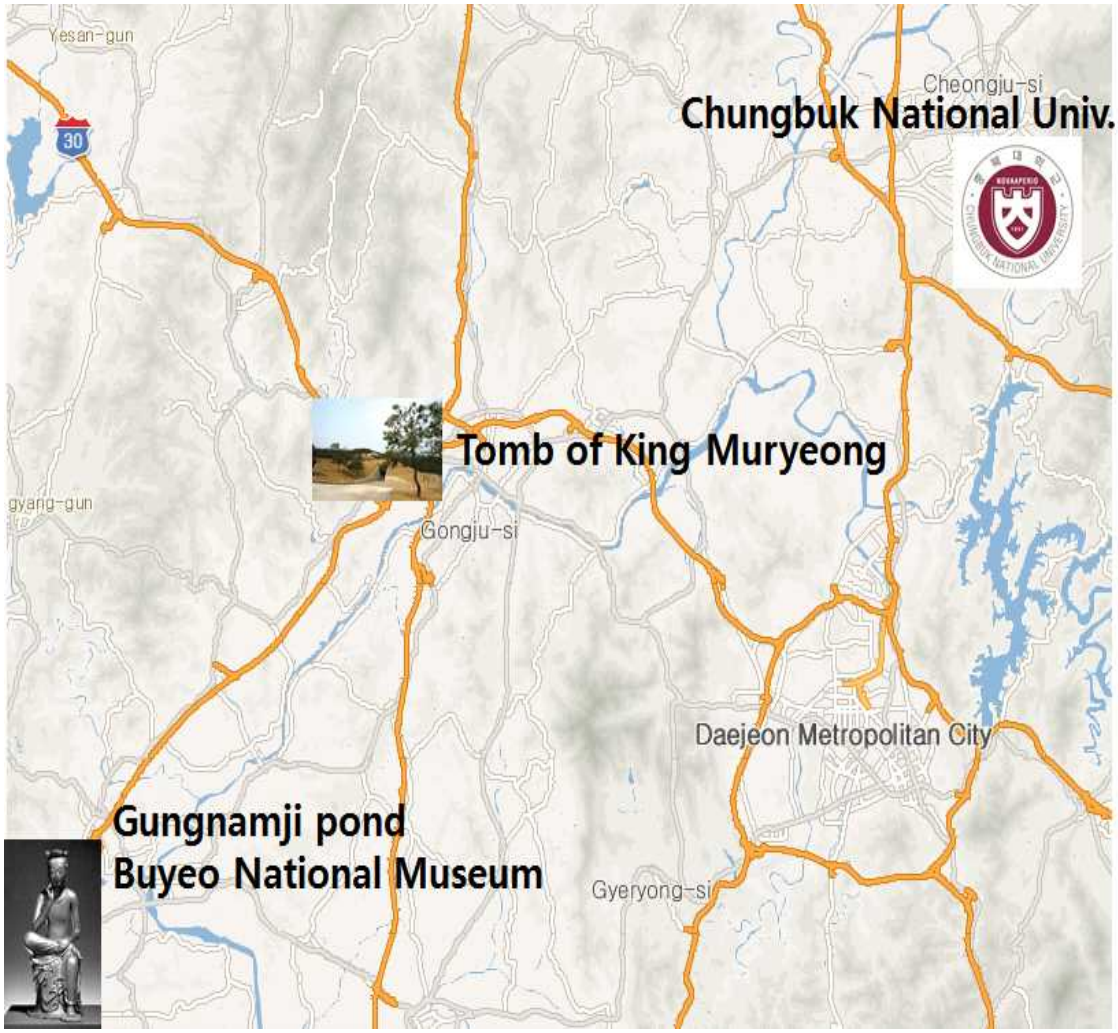
  We discuss the limit spectral distributions of large random matrices with dependent entries from a free probabilistic point of view.

  In this talk, first, we will see that such a limit spectral measure is a compound free Poisson law and, in the case where dependence is given by MA modeled Gaussian process, the sample covariance matrix can be regarded as compound Wishart matrix and, hence, gives the random matrix model for a compound free Poisson law. We can also evaluate the fluctuations of moments of the limit distribution. Finally, we will treat a wider class of large random matrices with dependent entries.

  This talk is based on the joint work with Ayako Hasegawa and Noriyoshi Sakuma.

Excursion

11:40－12:30	Move to Gongju City from Chungbuk National University
12:30－13:30	Lunch
13:40－14:30	Tomb of King Muryeong
14:30－15:00	Move to Buyeo City from Gongju City
15:00－15:50	Gungnamji Pond
15:50－16:40	Buyeo National Museum
16:40－18:00	Move to Cheongju from Buyeo City
18:00－19:30	Dinner



Tomb of King Muryeong

This tomb was found when drainage work was conducted to prevent water penetration into the Songsanri old tombs in 1971 and excavated for the first time about 1,500 years after it was made. In particular, people were so excited because the tomb clearly recorded that the tomb was for King Muryeong and his wife. According to excavation, the tomb of King Muryong looked like a small hill . Its diameter was about 20m and its height was 7.7m from the bottom. However, as times went by, it was seriously damaged. Then, it is estimated that the tomb was much bigger than it is now.

The front side consists of a single room and the section is a long rectangular shape from south to north. There is a passage into a tomb in the middle. The wall is vertical from the top to the bottom, that is, south to north. The east and west side is formed with arch ceiling with gradual curve. The inner side of the tomb is 4.2m from south to north and 2.72m from east to west. The height from the top to the bottom in the middle is 3.14m. The tomb burying King and his wife is built in the basic dimension without waste of space. On the walls, long bricks and small bricks are piled up in turn. Four long bricks are horizontally piled up and 11 small bricks are vertically piled up in four horizontal piling and one vertical piling method.

Gungnamji Pond

Samguk Sagi, a book about the history of three kingdoms (Goguryeo, Baekje, and Silla), says that a lame was dug to the south of the royal palace in the 35th year of the reign of King Mu (AD 634) in the Baekje Kingdom. It records that the water for the lake was brought by an 8km waterway from the water source, willow trees were planted around the bank and an artificial mound was made in the middle of the lake to symbolize the mountain where the chief abbot resided.

The account in the history book tells us that the lake was in the royal palace ground. The foundation stones, plinths and shards of tiles and vessels of Baekje unearthed on the low hill east of the lake leads us to believe there had once been a detached palace near the hill.

Gungnamji, which expressed immortal thought with the islet in its middle, was one of the earliest lakes made in the garden in Korea. This lake proves the Baekje was most expert in garden building of three kingdoms. King Mu and Princess Seonhwa of Silla who had been married after a legendary romance lived in this palace.

Buyeo National Museum

The Buyeo National Museum has 10,000 relics that were discovered from various historic sites. There is a prehistoric exhibit centering on the Bronze Age, a historic exhibit with Baekje relics, Buddism and art exhibit, and outdoor exhibit area, and the Professor Park Man-sik commemoration exhibit.

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Campus Map

N1	Guard House for Main Gate	S1-1	College of Natural Sciences 1
N2		S1-2	College of Natural Sciences
N3		S1-3	Natural Science College
N4	Industrial Academic Research Center	S1-4	College of Natural Sciences
N5	Building of Lifelong Education Center	S1-5	No.3 Building
N6	Dormitory	S1-6	
N7	Library, Hyeongeseol Building	S1-7	
N8	Auditorium	S2	Infomation System Center
N9	International Educational Center	S3	
N10	General Administration Building	S4-1	College of Pharmacy
N11	General Experiment and Practive Center	S4-2	
N12	Central Library	S5-1	Laboratory of Dept
N13	College of Business	S5-2	Warehouse of Agriculture
N14		S6-1	Greate Green House1
N15	College of social Sciences	S6-2	Greate Green House2
N16-1	College of Humanites	S7-1	Laboratory Building
N16-2		S7-2	
N16-3	Department of Art	S8	Outdoor Auditorium
N17-1	Guard Office of Domitory	S9	Museum
N17-2	Administration Buiding of Dormmitory	S10	Garage
N17-3	Dormitory of Male Students A	S11	
N17-4	Dormitory of Male Students B	S12	Refuse Disposal Center
N17-5	Dormitory of Male Students C	S13	Capentry House
N17-6		S14	No.2 Student Union Building
N18	College of Law Building	S15	No.1 Main Building
N19	No.2 Main Building	S16	General Administrative Building
N20-1	Home Economics Building	S17-1	
N20-2	Day-care Center	S17-2	
N21	Eunhasu Restaurant	S17-3	
E1-1		S17-4	
E1-2	College of Education	S17-5	Dormitory for Female Students
E2	Hall of NOVA APERIO Culture	S17-6	Dormitory Female Student
E3	No.1 Student Union Building	S17-7	Administration Building of Dormitory
E4-1	Gymnasium	S18	
E4-2	Pharmaceutical Science and Technology	S19	Tumor Research center
E4-3	Secondary Sports Center	S20	
E5	R.O.T.C.	S21-1	
E6	Transformer Station	S21-2	Forest Products Processing Plant
E7-1	College of Medicine	S21-3	
E7-2	University Hospital	S21-4	College of Agriculture
E7-3		S21-5	College of Agriculture(Laboratory Building)
E8-1	Engineering Building	S21-6	Drying Room
E8-2	Common Lecture Rooms	S21-7	
E8-3	Construction Engineering Building	S21-8	
E8-4	No.1 Factory Building	S21-9	
E8-5	No.2 Factory Building	S21-10	
E8-6	College of Engineering	S21-11	
E8-7	College of Engineering Building	S21-12	
E8-8	Engineering Support Center	S21-13	
E8-9		S21-14	
E8-10		S21-15	
E9	Industrial Techmology Research Park	S21-16	
E10	Industrial Techmology Education Center	S21-17	
E11-1		S21-18	
E11-2		S21-19	Net House
E11-3		S21-20	
E11-4		S21-21	Management Building
E11-5	Silo	S21-22	Center for Management
E12-2	No.2 Veterinary Medicine Science Center	S21-23	Center for Management
E12-1	Animal Hospital	S21-24	College of Agticulture (Factory)
E12-3	Anmal Farm for Experimentation		

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