21 (Mon) of November

[9:40 ~ 10:20]
Joonwoo Bae (Hanyang University)

Title : Distinguishability, the No-Signaling Principle, and Secret Information Flow

Abstract : In this talk, I show that in generalized probabilistic theories including quantum theory, distinguishability is tightly connected to the no-signaling principle. The connections to other operational tasks, e.g. computational capability, information flow and Markovianity, are also discussed.

References
[1] J Bae et al., Entropy 18 39 (2016)
[2] J Bae, Electronic Proceedings in Theoretical Computer Science 171 26 (2014)
[3] M. Song, H.-P. Breuer and J. Bae, Work in Progress

[10:20 ~ 11:00]
T.J. Volkoff (Konkuk University)

Title: Distinguishability times and maximal metrological usefulness: two-mode, number-conserving bosonic Hamiltonians

Abstract: I will state and prove a lower bound for the time required for an initial quantum state to evolve to another quantum state on a unitary path and relate this inequality to the maximal metrological usefulness of the initial state for probing the strength of the generator of the unitary evolution. As an example, I will consider a dilute gas of N spinless bosons distributed among two modes.

References:

T.J.V., Phys. Rev. A 94, 042327 (2016).
T.J.V., K.B. Whaley, Phys. Rev. A 90, 062122 (2014).
T.J.V., K.B. Whaley, arXiv 1508.04181 (2015).

[11: 20 ~ 12:00]
Akihito Soeda (University of Tokyo)
Title: Universal controllization: its no-go and remedy for projective measurement of energy

Abstract: A versatile conditioning of a logic gate is easily achieved in classical logic circuits. Its quantum counterpart, which we call universal controllization, cannot be achieved due to entanglement. We circumvent this no-go result by adding an extra feature commonly available when the target gates are realized by a quantum system driven by its internal Hamiltonian. With this universal controllization algorithm, we construct an implementation scheme for projective measurement of energy on a quantum system, whose dimension and upper bound on its energy scale are given but otherwise unknown. The scheme uses a "quantum computer" coupled to the quantum system and exponentially improves the implementation time lower bound compared to a quantum-tomography based scheme by adapting quantum phase estimation.

Reference: Phys. Rev. Lett. 114, 190501 (2015)

[12:00 ~ 12:40]
Youngrong Lim (Korea Institute for Advanced Study)

TBA

[15:00 ~ 15:40]
Kimin Park (Palacky University)

Title: Atom-field interaction for quantum simulation of a nonlinear potential

Abstract: I will talk about a way of implementing a class of nonlinear operations by sequential application of conditional gates based on atom-field interactions such as Jaynes-Cummings and Rabi interactions and projective measurements. We demonstrate performance of the approach on the example of the cubic nonlinearity by several different ways in which the full nonlinear operation can be decomposed into sequences of the individual gates. It is shown that an high strength nonlinear gate such as cubic gate can be built asymptotically at optimal success probability. This scheme brings many advantages over the previously proposed all-optical methods and can be applied to several available experimental platforms, such as cavity quantum electrodynamics, trapped ions, and others.

Reference: [1] Kimin Park, Petr Marek, and Radim Filip, PHYS. REV. A, 94, 012332 (2016).
[2] Kimin Park, Petr Marek, and Radim Filip, submitted to PHYS. REV. A.

[15:40 ~16:20]
Omkar Srikrishna (Seoul National University)

Title : Characterizing open quantum dynamics using quantum error correcting codes

Abstract :
Characterizing noisy quantum processes is important to quantum computation and communication (QCC), since quantum systems are generally open. I would discusses a method, “quantum error correction based characterization of dynamics,” in which the initial state is any element from the code space of a quantum error correcting code that can protect the state from arbitrary errors acting on the subsystem subjected to unknown dynamics. The statistics of stabilizer measurements, with possible unitary preprocessing operations, are used to characterize the noise, while the observed syndrome can be used to correct the noisy state.

References :
1. “Characterization of quantum dynamics using quantum error correction”, S. Omkar, R. Srikanth, Subhashish Banerjee. Phys. Rev. A, 91, 012324 (2015).

2. “Quantum code for quantum error characterization”, S. Omkar, R. Srikanth, Subhashish Banerjee. Phys. Rev. A, 91, 052309 (2015).

[16:40~17:20]
Alexandre Roulet (National University of Singapore)

Title: Autonomous Rotor Heat Engine

Abstract: The triumph of heat engines is their ability to convert thermal energy into useful mechanical motion. In recent years, much effort has been devoted to generalizing thermodynamic notions to the quantum regime, partly motivated by the promise of surpassing classical heat engines. In this talk, we adopt a bottom-up approach and propose a realistic autonomous heat engine that can serve as a testbed for quantum effects in the context of thermodynamics. Our model draws inspiration from actual piston engines and is built from closed-system Hamiltonians and weak bath coupling terms. We present a classical analytical description in terms of nonlinear Langevin equations, as well as numerical simulations of the master equation in the quantum regime, where free dispersion and measurement backaction noise generally lower the engine's performance.

Reference: arXiv:1609.06011

[17:20~18:00]
Jinhyoung Lee (Hanyang University)

Title: Coherent states and their Nonclassicality

Authors: Jeong Woo Jae, Kang Hee Seol, Kwang-Geol Lee, and Jinhyoung Lee

Abstract: Quantum optics understands coherent states are the most classical quantum states in terms of Glauber-Sudarshan P function. The coherent states have P functions being nonnegative on the whole phase space. In this sense their P functions are probability measures and they are said to be classical (at least nominally). Some measures have been proposed to play the roles of P functions in identifying the nonclassicality. For instance, Mandel's Q factor. More recently, sub-binomiality, whose values are supposed to be negative for nonclassical states. We show that coherent states can have the negative sub-binomiality. However, we also prove the existence of a classical model that simulates the negativity, implying that the negativity of sub-binomiality is no genuine signature for nonclassicality. Instead, we propose another measure, with respect to that the classical model cannot simulate the quantum expectation. This measure identifies whether the input field is always divisible. It is affirmative for the classical field, whereas negative eventually for photons. We show that the coherent states can not be simulated by the classical model with respect to the measure. This result implies that the coherent states are nonclassical against the infinite divisibility of the classical field.

22 (Tue) of November

[9:40 ~ 10:20]
Cedric Beny (Hanyang University)

Title: Inferring effective models using quantum information geometry

Abstract: One way of thinking about the difference between quantum theory, classical probability theory, or generalized probability theories, is in terms of the distinguishability structure of the set of states. It can be thought of as a geometry, defined by a distinguishability metric such as the Fisher information. When information about a quantum system is lost, say because it is sent through a quantum channel, this geometry changes. For instance, if the information is broadcast, the shape of the set of states contracts approximately to that of a classical theory. In order to make this point of view practical for deriving effective theories, it is necessary to develop a way of characterizing how a manifold might approximate another in this context. I will present progress in developing such an approach.

Reference: arXiv:1511.05090, arXiv:1509.03249, arXiv:1402.4949, arXiv:1310.3188

[10:20~11:00]

Experimental demonstration of quantum machine learning speedup with classical data

Joong-Sung Lee, Sunghyuk Hong, Jeongho Bang, Changhyoup Lee, Seokwon Yoo, Kanghee Seol, Jinhyoung Lee, and Kwang-Geol Lee

Hanyang University, Seoul 04763, Korea

***Abstract*—We compare learning speed of classical and quantum machine learning in a binary classification of classical data. The learning speed of quantum machine learning depends on quantum phase. Enhancement of the learning speed is possible in the quantum machine learning in comparison to the classical machine learning even the absence of prior information about quantum phase. We experimentally show 37% enhancement of quantum machine learning.**

I. Introduction and Background

Quantum machine learning is a machine learning which exploit features of quantum physics such as quantum superposition and quantum interference. One of the remarkable results is the `quantum support vector machine (QSVM)', which is the method to classify large quantum data [1]. In the work of Ref. [1], it was shown that QSVM can exhibit an exponential learning speedup over its classical counterpart. An experiment of QSVM has also been performed on a small-scale quantum processor which classifies several number of quantum vectors [2]. Although the quantum machine learning achieve worthy results to learn the quantum data, it is important to learn the classical data because all present data is classical data. We investigate machine learning in a binary classification problem of classical data. In the previous work we theoretically showed the learning speed up in the machine learning with classical data samples through quantum process [3]. In this paper, we report the clear experimental demonstration of the quantum learning speed up and reveal the role of quantum phase in the quantum machine learning.

II. Results

We consider a machine to learn a binary classification problem for classical data. The binary classification is to perform the mapping, $\vec{x} \to y \in \{0,1\}$, where $\vec{x} = (x_0, x_1, \cdots, x_{n-1})$ denotes a n-bit classical vector of a specific data. This task can be applied to E-mail spam filtering, bankruptcy prediction problem and etc. When $\vec{x}$ is 1-bit, it is possible following 4-task:

$$\text{Task 1}: x \to 0$$
$$\text{Task 2}: x \to 1$$
$$\text{Task 3}: x \to x$$
$$\text{Task 4}: x \to x \oplus 1,$$

where $\oplus$ denotes a modulo-2 operation. Figure 1 shows a binary classification machine for 1-bit. All possible 1-bit task can be implemented by choosing a suitable 1-bit operator G_0 and 1-bit conditional operator G_1 . Classical machine is composed of classical 1-bit operator, *i.e.*, identity operator and NOT operator. Quantum machine is composed of 2×2 unitary operator which treats quantum phase in contrast with the classical operator. For example, task 1 is implemented when G_0 and G_1 are identity operators in the classical machine and $G_0 = G_1 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ in quantum machine.

Before the learning is completed, the classical machine probabilistic choose the identity operator and NOT operator without knowing exactly the correct operator. p_j is a probability to choose the identity operator in G_j and $1 - p_j$ is a probability to choose the NOT operator in G_j. As the learning progressed, p_j approach to a solution. for the sake of the fair competition of the classical machine learning and the quantum machine learning, we consider a restricted unitary operator in the quantum machine which perform a identity operator with p_j probability and a NOT operator with $1 - p_j$ probability given by

$$\hat{G}_j = \begin{pmatrix} \sqrt{p_j} & e^{i\phi_j}\sqrt{1-p_j} \\ e^{-i\phi_j}\sqrt{1-p_j} & -\sqrt{p_j} \end{pmatrix},$$

where ϕ_j is quantum phase. We adopt a differential evolution as a learning algorithm. The parameters of learning algorithm are optimized to the classical machine learning. For task 1, fidelity is given by

$$F_C = \sqrt[4]{p_0(p_0 p_1 + q_0 q_1)},$$
$$F_Q = \sqrt[4]{p_0(p_0 p_1 + q_0 q_1) + 2p_0\sqrt{p_0 p_0 q_0 q_0}\cos\Delta},$$

where $F_C(F_Q)$ is fidelity of the classical machine(quantum machine), $\Delta = \phi_0 - \phi_1$. It notes that the quantum fidelity is enhanced or reduced as the quantum phase in comparison with the classical fidelity. Despite absence of the prior information about optimal quantum phase, we always get benefits of quantum phase where $\Delta = \pi(p_0 - p_1)$ which we call general phase.

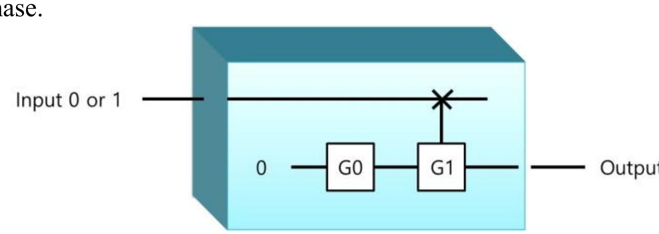

Figure1. Binary classification machine for 1-bit. $G_0(G_1)$ is a probabilistic operator.

References

[1] P. Rebentrost, M. Mohseni, and S. Lloyd, Phys. Rev. Lett. **113**, 130503 (2014)
[2] Z. Li, X. Liu, N. Xu, and J. Du, Phys. Rev. Lett. **114**, 140504 (2015)
[3] S. Yoo, J. Bang, C. Lee, and J. Lee, New J. Phys. **16**, 103014 (2014)

[11:20~12:00]

Framework for distinguishability of orthogonal bipartite states by one-way local operations and classical communication

Tanmay Singal*

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1 Abstract

In the topic of perfect local distinguishability of orthogonal multipartite quantum states, most results obtained so far pertain to bipartite systems whose subsystems are of specific dimensions. In contrast very few results for bipartite systems whose subsystems are of arbitrary dimensions, are known. This is because a rich variety of (algebraic or geometric) structure is exhibited by different sets of orthogonal states owing to which it is difficult to associate some common property underlying them all, i.e., a common property that would play a crucial role in the local distinguishability of these states. In this paper, I propose a framework for the distinguishability by one-way LOCC (1-LOCC) of sets of orthogonal bipartite states in a $d_A \otimes d_B$ bipartite system, where d_A, d_B are the dimensions of both subsytems, labelled as A and B. I show that if the i-th party (where $i = A, B$) can initiate a 1-LOCC protocol to perfectly distinguish among a set of orthogonal bipartite states, then the information of the existence of such a 1-LOCC protocol lies in a subspace of $d_i \times d_i$ hermitian matrices, denoted by $\mathcal{T}_\perp^{(i)}$, and that the method to extract this information (of the existence of this 1-LOCC protocol) from $\mathcal{T}_\perp^{(i)}$ depends on the value of $dim\mathcal{T}_\perp^{(i)}$. In this way one can give sweeping results for the 1-LOCC (in)distinguishability of all sets of orthogonal bipartite states corresponding to certain values of $dim\mathcal{T}_\perp^{(i)}$. Thus I propose that the value of $dim\mathcal{T}_\perp^{(i)}$ gives the common underlying property based on which sweeping results for the 1-LOCC (in)distinguishability of orthogonal bipartite quantum states can be made.

References

[1] Singal, T, Phys. Rev. A 93, 030301(R), (2016)

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[12:00~12:40]
Daniel McNulty (Hanyang University)

Title: Entanglement witnesses from quantum 2-designs

Abstract: We construct inequalities for detecting entangled states using quantum 2-designs. In particular, we derive simple inequalities for a bipartite state by performing local measurements which constitute a quantum 2-design, e.g. symmetric informationally complete POVMs or mutually unbiased bases. When the dimension is large this approach is useful experimentally since only a few local measurements are needed for entanglement detection.

[15:00~15:40]
Jaewook Ahn (KAIST)

Title: Making a designer's atomic qubit array

Abstract: Neutral atoms arranged in space may be a useful platform for quantum computation, quantum simulation, and quantum many-body physics studies. Using dynamics holographic optical tweezers, we recently demonstrated N neutral single atoms can be rearranged simultaneously in three-dimensional space. In this talk, with refined methods utilizing Hungarian matching algorithm and superposition holographic masks, we show the number of atoms is increased to N=50, enabling deterministic loading of N/2=25 single atoms onto arbitrary 1D and 2D atoms arrays.

Reference: Kim et al., "In situ single-atom array synthesis by dynamic holographic optical tweezers," Nature Communications 7, 13317 (2016).

[15:40~16:20]
Yong Siah Teo (Seoul National University)

Title: Homodyne vs Heterodyne in moment tomography.

Abstract: We present results showing the advantages of heterodyne (double homodyne) tomography over the conventional homodyne tomography in moment estimation problems.

Reference: SCIREP 5, 12289 (2015); PRL 117, 070801 (2016)

[16:40~17:20]
Wonmin Son (Sogang University)
TBA

23 (Wed) of November

[9:40~10:40]
Eran Ginossar (University of Surrey)

Title: Protected ground states in short chains of coupled spins in circuit quantum electrodynamics

Abstract:
Combining superconducting qubits with mesoscopic devices that carry topological states of matter may lead to compact and improved qubit devices with properties useful for fault-tolerant quantum computation [1,2]. A complementary approach is designed to realise topologically protected states by engineering certain interactions between superconducting qubits. The anisotropic Heisenberg spin realised with a chain of qubits can encode quantum information, but its degree of protection against local perturbations is known to be only partial. We examine the ground state of the system when adding non-local interactions specifically considering circuit quantum electrodynamics [3]. We find a phase with two ground states which are highly protected against all local field perturbations. We show that the protection persists across a range of parameters even away from the ideal point. We also discuss how in this architecture for the locally interacting case the coupling between two ground states can be used to observe signatures of topological edge states in a small controlled chain of superconducting transmon qubits.

References:
[1] Microwave transitions as a signature of coherent parity mixing effects in the Majorana-transmon qubit, Eran Ginossar and Eytan Grosfeld, Nature Communications 5, 4772 (2014)
[2] Fermion parity measurement and control in Majorana circuit quantum electrodynamics, Konstantin Yavilberg, Eran Ginossar, Eytan Grosfeld, Phys. Rev. B 92, 075143 (2015)
[3] Protected ground states in short chains of coupled spins in circuit quantum electrodynamics, Adam Callison, Eytan Grosfeld, Eran Ginossar, arXiv:1602.00299 (2016)

[11:00~12:00]

Kazuki Koshino (Tokyo Medical and Dental University)

Title: Tunable quantum gate between a superconducting atom and a propagating microwave photon

Abstract: In this talk, I propose a new scheme for implementing deterministic two-qubit gates between a superconducting atom and a propagating microwave photon [1]. In the proposed device, a driven superconducting atom is coupled to a waveguide photon via a resonator. Previously, this device has been applied to constitute an "impedance-matched" Lambda system that deterministically absorbs a single microwave photon [2,3] and thus enables high-efficiency detection of microwave photons [4,5]. In the proposed atom-photon gate, the atomic qubit is encoded on its two lowest levels, and the photon qubit is encoded on its carrier frequencies. The gate operation completes deterministically upon reflection of a photon. A remarkable feature of the proposed gate is its tunability: through in situ control of the drive field to the atom, we can continuously change the gate type, including SWAP, (SWAP)^{1/2}, and Identity gates which are of practical importance. Furthermore, by cascading the proposed devices, we can execute an entangling gate between two remote superconducting atoms. This implies the realization of a universal gate set, since one-qubit gate operations are easy in superconducting atoms.

Reference:

[1] K. Koshino, K. Inomata, Z. R. Lin, Y. Tokunaga, T. Yamamoto, and Y. Nakamura: arXiv:1610.02104.
[2] K. Koshino, K. Inomata, T. Yamamoto and Y. Nakamura: Phys. Rev. Lett. 111 (2013) 153601.
[3] K. Inomata, K. Koshino, Z. R. Lin, W. D. Oliver, J. S. Tsai, Y. Nakamura and T. Yamamoto: Phys. Rev. Lett. 113 (2014) 063064.
[4] K. Koshino, K. Inomata, Z. Lin, Y. Nakamura and T. Yamamoto: Phys. Rev. A 91 (2015) 043805.
[5] K. Inomata, Z. R. Lin, K. Koshino, W. D. Oliver, J. S. Tsai, T. Yamamoto and Y. Nakamura: Nat. Commun. 7 (2016) 12303.

[12:00~12:40]

MunDae Kim (KIAS)

Title: Quantum gate operation in the circuit-QED lattice with circulator function

Abstract: We propose a scheme for a scalable quantum computing in the circuit-quantum electrodynamics(QED) architecture. In the Kagome lattice of qubits three qubits are connected to each other through a superconducting three-junction flux qubit at the vertices of the lattice. By controlling one of the three Josephson junction energies of the intervening flux qubit we can achieve the circulator function that couples arbitrary pair of two qubits among three. This selective coupling enables the interaction between two nearest neighbor qubits in the Kagome lattice, and further the quantum gate operation between any pair of qubits in the whole lattice through consecutive two-qubit gates.

[15:00~15:40]
Heejung Lee (KRISS)

Title : Experimental demonstration of high-dimensional photonic spatial entanglement between multi-core optical fibers

Abstract :
Fiber transport of multi-dimensional photonic qudits promises high information capacity per photon without space restriction. This work experimentally demonstrates transmission of spatial qudits through multi-core optical fibers and measurement of the entanglement between two fibers with quantum state analyzers, each composed of a spatial light modulator and a single-mode fiber. Quantum state tomography reconstructs the four-dimension entangled state that verifies the non-locality through concurrences in two-dimensional subspaces and a high dimensional Bell-type CGLMP inequality.

References :
1. D. J. Richardson, J. M. Fini, and L. E. Nelson, “Spacedivision multiplexing in optical fibres,” Nature Photon. 7,
354 (2013).
2. A. C. Dada, J. Leach, G. S. Buller, M. J. Padgett, and E. Andersson, “Experimental high-dimensional two-photon entanglement and violations of generalized bell inequalities,” Nature Phys. 7, 677 (2011).
3. D. Collins, N. Gisin, N. Linden, S. Massar, and S. Popescu, “Bell inequality for arbitrarily high-dimensional systems,” Phys. Rev. Lett. 88, 040404 (2002).
4. H. J. Lee, H. S. Moon, S.-K. Choi, and H. S. Park, “Multicore fiber interferometer using spatial light modulators for measurement of the inter-core group index differences,” Opt. Express 23, 12555 (2015).

[15:40~16:20]

Junghee Ryu (National University of Singapore)

Title

Entanglement indicators for bright multi-mode quantum optical fields

Abstract

Here we shall study entanglement conditions for bright multi-mode quantum optical fields of undefined intensities, essentially photon numbers [1]. To observe entanglement effects one can use multi-mode parametric down-conversion emissions. When the structure of the Hamiltonian governing the emissions has (infinitely) many equivalent Schmidt decompositions into modes (beams), one can have perfect EPR-like correlations of numbers of photons emitted into “conjugate modes”. We provide series of entanglement conditions expressed in terms of averages of observed rates, which is a generalization of the ones given in [2], and show their violations by bright multi-mode squeezed vacuum states. We also discuss this is a much better entanglement indicator than that in terms of usual intensity-related variables.

Reference

[1] J. Ryu, M. Marciniak, M. Wiesniak, and M. Zukowski, arXiv:1601.02233

[2] M. Zukowski, W. Laskowski, and M. Wiesniak, arXiv:1508.02368

[16:40~17:20]

Hong-Yi Su (Chonnam National University)

Title: General tradeoff relations of quantum nonlocality in the Clauser-Horne-Shimony-Holt scenario

Abstract: General tradeoff relations present in nonlocal correlations of bipartite systems are studied, regardless of any specific quantum states and measuring directions. Extensions to multipartite scenarios are possible and very promising. Tsirelson's bound can be derived out in particular. The close connection with uncertainty relations is also presented and discussed.

Reference: arXiv:1603.08196

[17:20~18:00]
Yonuk Chong, Taewan Noh (KRISS)

Title: Characterization and Optimization of Superconducting Qubit Gates

Abstract: Here we present our recent research on the development of protocols for correctly characterizing the quantum gates and improving the fidelity of them. During the last decades, there have been remarkable progresses in that aspect. We will present the implementation of those methods, such as the randomized benchmarking (RB), the quantum process tomography (QPT) and the gate set tomography (GST). We performed these characterization methods on our superconducting transmon qubit system. Additionally, we will show how to systematically perform the calibration of the gates to achieve consistently high fidelities by suppressing two typical types of gate errors in our system, i.e., the amplitude errors and the phase errors.

24 (Thu) of November

[9:40~10:20]
Bobby Tan Kok Chuan (Seoul National University)

Title: Disturbance Based Measure of Macroscopic Coherence

Abstract: In this talk, I will discuss a proposed measure of macroscopic coherence based on the degree of disturbance caused by a coarse-grained measurement. Based on our measure, we point out a separate proposal for identifying macroscopic coherence by Yadin and Vedral[1] cannot be sufficient to single out macroscopic coherence. Arguments are then presented that suggests our measure is able to avoid these deficiencies. An inequality relation is proved that relates the Wigner-Yanase-Dyson skew information and the measurement disturbance, which strengthens our arguments and suggest possible applications for quantum metrology. Our work provides a general framework of quantifying macroscopic coherence from an operational point of view, based on the relationship between the precision of the measurement and disturbance of the quantum state.

Reference: B. Yadin and V. Vedral, Phys. Rev. A 93, 022122 (2016).

[10:20~11:00]
Changsuk Noh (KIAS)

Title: Single-photon quantum nonlocality: violation of the CHSH inequality using feasible measurement setups

Abstract: We investigate quantum non-locality of a single-photon entangled state under feasible measurement set-ups involving on-off detection and/or homodyne detection along with Gaussian unitary operations—displacement and squeezing. Our results indicate that the non-locality as quantified by a violation of the CHSH inequality can be verified if two or less homodyne measurements are involved in total (out of 4 measurements). Furthermore, we find that the addition of squeezing to on- off detections leads to larger and more robust violations of the CHSH inequality. We summarise by presenting a table of CHSH-violation for Gaussian-unitary-assisted on-off and homodyne detection schemes.

Reference: Su-Yong Lee, Jiyong Park, Jaewan Kim and Changsuk Noh, submitted to Phys. Rev. A.

[11:20~12:00]
Chang-Woo Lee (KIAS)

Title: Keldysh approach to a nonequilibrium phase transition of Lipkin-Meshkov-Glick model

Abstract:
Keldysh's brilliant idea using a closed time contour has led to one of the most efficient analytical tools to describe non-equilibrium dynamics of condensed matter, atomic, and optical systems. It is based on real-time field theory and hence does not need the Wick rotation. It can also compare and hence unify the equilibrium and non-equilibrium descriptions, and in some cases when their universality classes coincide, make possible a mapping of the latter to the former. In this talk, a quantum optical realization of the dissipative Lipkin-Meshkov-Glick Model is reviewed and it will be shown that its quantum phase transition can be well (and more easily) described via the Keldysh formalism. Furthermore, some universal features of the Markovian dissipative dynamics and the mapping to the thermal equilibrium system will also be discussed.