External Awards

SIGGRAPH Asia 2022 Emerging Technologies Best Demo Award

Winners: Kengo Sato, Tokyo Institute of Technology; Hiroki Terashima, NTT Communication Science Laboratories; Shin'ya Nishida, Kyoto University/NTT Communication Science Laboratories; Yoshihiro Watanabe, Tokyo Institute of Technology
Date: December 9, 2022
Organization: Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH) Asia 2022

For "E.S.P.: Extra-sensory Puck in Air Hockey Using the Projection-based Illusion."
Published as: K. Sato, H. Terashima, S. Nishida, and Y. Watanabe, "E.S.P.: Extra-sensory Puck in Air Hockey Using the Projection-based Illusion," Proc. of SIGGRAPH Asia 2022, Article no. 3, Daegu, South Korea, Dec. 2022.

Best Paper Award

Winners: Masahiro Kohjima, NTT Human Informatics Laboratories; Yuta Nambu, NTT Human Informatics Laboratories; Yuki Kurauchi, NTT Human Informatics Laboratories; Ryuji Yamamoto, NTT Human Informatics Laboratories
Date: December 13, 2022
Organization: The 29th International Conference on Neural Information Processing (ICONIP 2022)

For "General Algorithm for Learning from Grouped Uncoupled Data and Pairwise Comparison Data."
Published as: M. Kohjima, Y. Nambu, Y. Kurauchi, and R. Yamamoto, "General Algorithm for Learning from Grouped Uncoupled Data and Pairwise Comparison Data," ICONIP 2022, Nov. 2022.

Specially Selected Paper

Winners: Ayako A. Hasegawa, National Institute of Information and Communications Technology; Naomi Yamashita, NTT Communication Science Laboratories; Mitsuaki Akiyama, NTT Social Informatics Laboratories; Tatsuya Mori, Waseda University
Date: December 15, 2022
Organization: Information Processing Society of Japan (IPSJ)

For "Experiences, Behavioral Tendencies, and Concerns of Nonnative English Speakers in Identifying Phishing Emails."
Published as: A. A. Hasegawa, N. Yamashita, M. Akiyama, and T. Mori, "Experiences, Behavioral Tendencies, and Concerns of Nonnative English Speakers in Identifying Phishing Emails," Journal of Information Processing, Vol. 30, pp. 841–858, 2022.

Young Scientist Award of the Physical Society of Japan

Winner: Yuki Takeuchi, NTT Communication Science Laboratories
Date: March 22, 2023
Organization: The Physical Society of Japan

For research on quantum supremacy of measurement-based quantum computation and its verification.
Published as: Y. Takeuchi, A. Mantri, T. Morimae, A. Mizutani, and J. F. Fitzsimons, "Resource-efficient Verification of Quantum Computing Using Serfling's Bound," npj Quantum Information, Vol. 5, Article no. 27, 2019.
Y. Takeuchi and T. Morimae, "Verification of Many-qubit States," Phys. Rev. X, Vol. 8, 021060, 2018.
Y. Takeuchi and Y. Takahashi, "Ancilla-driven Instantaneous Quantum Polynomial Time Circuit for Quantum Supremacy," Phys. Rev. A, Vol. 94, 062336, 2016.

Japanese Society of Crop Science Young Scientist Award

Winner: Kazuma Sakoda, NTT Space Environment and Energy Laboratories
Date: March 29, 2023
Organization: Crop Science Society of Japan

For his physiological and genetic study on leaf photosynthesis in crops in fluctuating environments.
Published as: K. Sakoda, Y. Tanaka, S. P. Long, and T. Shiraiwa, "Genetic and Physiological Diversity in the Leaf Photosynthetic Capacity of Soybean," Crop Science, Vol. 56, pp. 2731–2741, 2016.
K. Sakoda, S. Suzuki, H. Fukayama, Y. Tanaka, and T Shiraiwa, "Activation State of Rubisco Decreases with the Nitrogen Accumulation during the Reproductive Stage in Soybean [*Glycine max* (L.) Merr.], Photosynthetica, Vol. 57, No. 1, pp. 231–236, 2019.
K. Sakoda, A. Kaga, Y. Tanaka, S. Suzuki, K. Fujii, M. Ishimoto, and T. Shiraiwa, "Two Novel Quantitative Trait Loci Affecting the Variation in Leaf Photosynthetic Capacity among Soybeans," Plant Science, Vol. 291, 110300, 2019.

Papers Published in Technical Journals and Conference Proceedings

Topological Thouless Pumping in Arrays of Coupled Spin Chains

V. M. Bastidas

Physical Review B, Vol. 106, No. 22, L220308, December 2022.

Thouless pumping is a mechanism to perform the topologically protected transport of particles by adiabatically modulating the Hamiltonian. The transported current is a topological invariant that is intimately related to the integer quantum Hall effect. Most of the previous works focus on topological pumping in linear and square lattices. In this Letter, we theoretically propose a mechanism to perform topological pumping in arrays of spin chains with complex geometries. To achieve this, we consider an array where the spin chains are coupled through their edges, which allows us to split the populations to generate superpositions of spin excitations in different spin chains. We show that due to the topological protection, the quantum superpositions can be transported through the array against the effect of disorder. This approach will open another avenue to transport excitations and correlated states with potential applications in quantum technologies and information processing. Our ideas can be realized in state-of-the-art quantum simulators such as cold atoms and superconducting qubit arrays.

Finite-key Security Analysis of Differential-phase-shift Quantum Key Distribution

A. Mizutani, Y. Takeuchi, and K. Tamaki

arXiv:2301.09844, January 2023.

Differential-phase-shift (DPS) quantum key distribution (QKD) is one of the major QKD protocols that can be implemented with a simple setup using a laser source and a passive detection unit. Recently, an information-theoretic security proof of this protocol has been established in [npj Quant. Inf. 5, 87 (2019)] assuming the infinitely large number of emitted pulses. To implement the DPS protocol in a real-life world, it is indispensable to analyze the security with the finite number of emitted pulses. The extension of the security proof to the finite-size regime requires the accommodation of the statistical fluctuations to determine the amount of privacy amplification. In doing so, Azuma's inequality is often employed, but unfortunately we show that in the case of the DPS protocol, this results in a substantially low key rate. This low key rate is due to a loose estimation of the sum of probabilities regarding three-photon emission whose probability of occurrence is very small. The main contribution of our work is to show that this obstacle can be overcome by exploiting the recently found novel concentration inequality, Kato's inequality. As a result, the key rate of the DPS protocol is drastically improved. For instance, assuming typical experimental parameters, a 3 Mbit secret key can be generated over 77 km for 8.3 hours, which shows the feasibility of DPS QKD under a realistic setup.