RIKEN QUANTUM COMPUTING

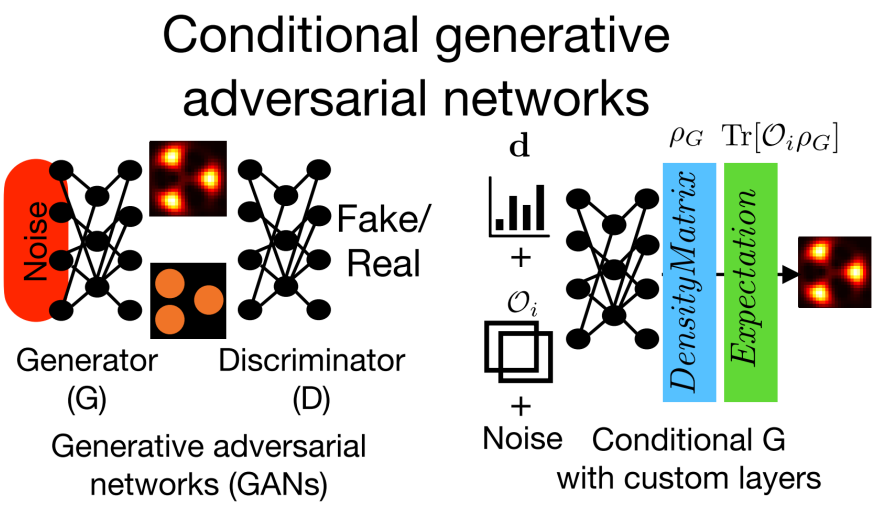
Quantum Information Physics Theory Research Team

Research overview

We perform theoretical studies of quantum information processing, quantum circuits, quantum optics, software for quantum information, and also use techniques from AI and machine learning to solve computationally hard problems.

Recent achievements

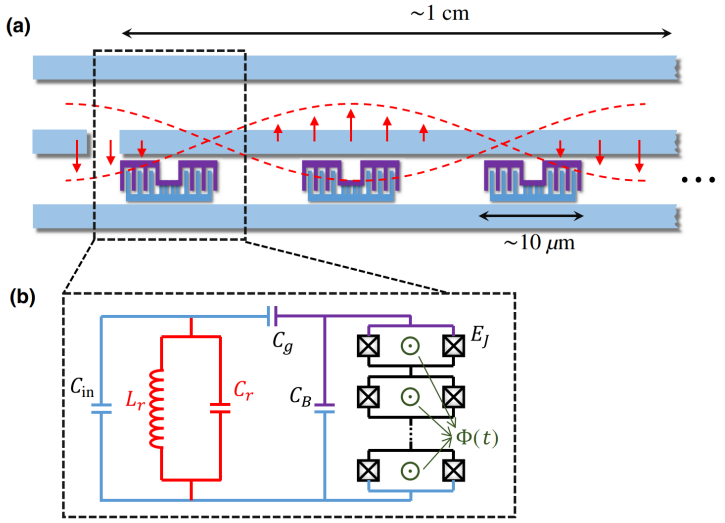
AI and Machine Learning applied to Quantum Computing



We classified and reconstructed optical quantum states of superconducting circuits with deep adversarial neural networks.

S. Ahmed, et al., *Quantum State Tomography with Conditional Generative Adversarial Networks* Phys. Rev. Lett. **127**, 140502 (2021); *Classification and reconstruction of optical quantum states with deep neural networks,* Phys. Rev. Research **3**, 033278 (2021).

Quantum Error Correction



We proposed a theoretical protocol to implement multiqubit geometric gates using photonic cat-state qubits.

Y.H. Chen, R. Stassi, W. Qin, A. Miranowicz, F. Nori, Fault-Tolerant Multiqubit Geometric Entangling Gates Using Photonic Cat-State Qubits, Phys. Rev. Applied 18, 024076 (2022).

RIKEN QUANTUM COMPUTING

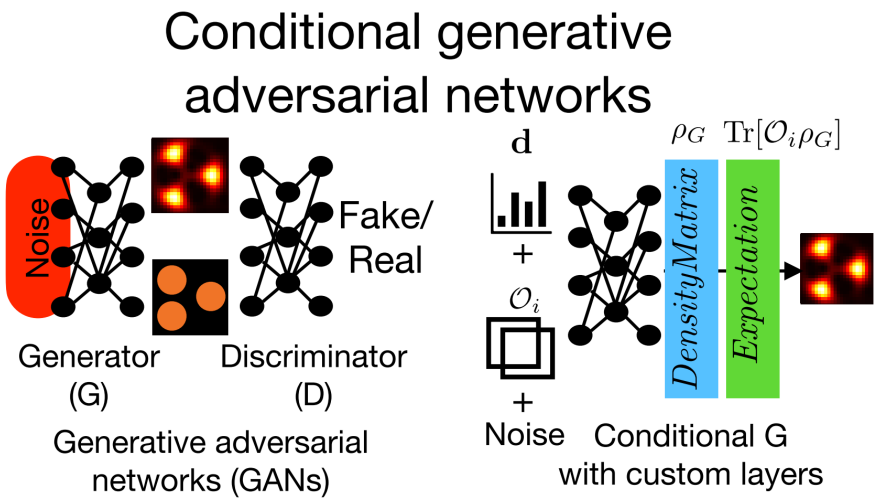
量子情報物理理論研究チーム

研究概要

量子情報処理、量子回路、量子光学、量子情報用ソフトウェアの理論的研究を行うとともに、AI（人工知能）や機械学習の技術を駆使して計算困難な問題の解決に取り組んでいる。

最近の研究成果

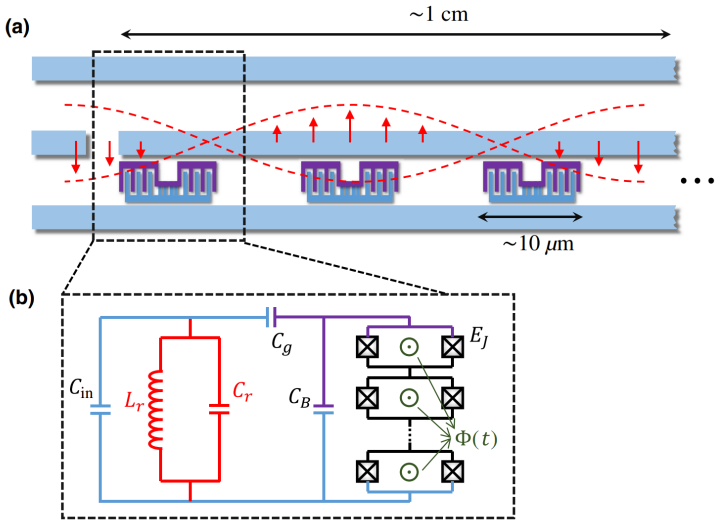
AIと機械学習の量子コンピューティングへの応用



超伝導回路の光量子状態を深層敵対的ニューラルネットワークで分類し、再構成した。

S. Ahmed, et al., *Quantum State Tomography with Conditional Generative Adversarial Networks* Phys. Rev. Lett. **127**, 140502 (2021); *Classification and reconstruction of optical quantum states with deep neural networks,* Phys. Rev. Research **3**, 033278 (2021).

量子誤り訂正



フォトニックキャットステート量子ビットを用いたマルチ量子ゲート実装のための理論プロトコルを提案した。

Y.H. Chen, R. Stassi, W. Qin, A. Miranowicz, F. Nori, Fault-Tolerant Multiqubit Geometric Entangling Gates Using Photonic Cat-State Qubits, Phys. Rev. Applied 18, 024076 (2022).