Noise correlations in spin qubits

Juan Rojas-Arias

RIKEN Center for Quantum Computing (RQC), Wako-shi, Saitama, Japan

Spin qubits are among the leading platforms for scalable quantum computing, thanks to their compact size and compatibility with semiconductor fabrication technologies. However, their solid-state nature exposes them to various sources of noise arising from uncontrolled interactions with the environment. The nature and correlation properties of this noise play a crucial role in determining the performance of quantum processors, particularly in the context of quantum error correction.

In this talk, I will provide an overview of spin qubits and the dominant noise mechanisms that affect their coherence. I will then present our recent work on the characterization of noise sources and their spatial correlations across multiple devices. Finally, I will discuss our latest results from a 5-qubit linear array, highlighting how noise correlations scale with interqubit distance and their implications for the performance of the repetition code in quantum error correction.

References

[1] J. Yoneda, J.S. Rojas-Arias et al., Nature Physics **19**, 1793 (2023).
[2] J. S. Rojas-Arias et al., Phys. Rev. Appl. **20**, 054024 (2023).
[3] J. S. Rojas-Arias et al., arXiv:2408.13707 (2024).
[4] J. S. Rojas-Arias et al., arXiv:2505.05875 (2025).