A long-lived Spin Qubit Pair in Germanium with Matching g-tensors

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The development of Ge/SiGe hole spin qubits has highlighted the critical role of material quality in reducing disorder and enhancing qubit performance [1]. However, strong dot-to-dot variations of the g-tensor in strained Ge quantum wells can lead to substantial variability in the characteristics of each qubit over large arrays, creating a major obstacle to the scalability of this platform [2].

In this study, we observe the properties of spin-qubit pair in a Ge/SiGe heterostructure grown on Ge wafers. We show that the less strained material yields matched g-tensors over short length scales, enabling locally uniform qubit pairs.

We further characterize the coherence properties of both spins, observing long-lived qubits with a **T 2*** of up to **21 us** and a **Hahn Echo T 2** of almost **390 us**. Finally, we demonstrate mutual sweet spots [4] without imposing stringent requirements on the electrical tuning of the pair.

References

[1] Stehouwer *et al.*, *Nature Materials* **24**, 845–853 (2025).
[2] John *et al.*, *Nature Communications* **16**, 10560 (2025).
[4] Bassi *et al.*, arXiv:2412.13069 (2024).

Figures

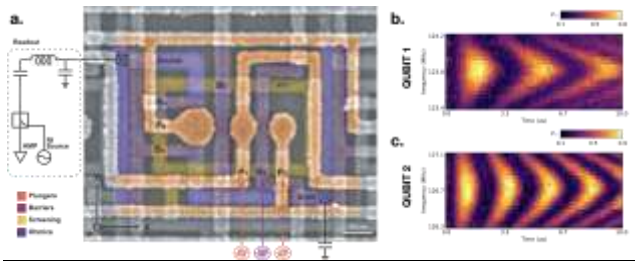

Figure 1: a) False-color scanning electron microscope (SEM) image highlighting a tile within the QARPET architecture. The tile comprises a sensing dot and a double quantum dot. Rabi chevron experiments for qubits Q_1(b) and Q_2 (c)

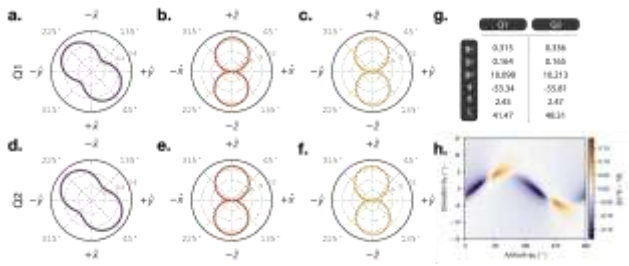

Figure 2: Matching g tensor for Qubit 1 and Qubit 2 (a-f). g) Eigenvalues and Euler angles comparison for both g-Tensors. h) The normalized between the g-factors of Q1 and Q2, highlighting the impressive similarity between the two qubits.