Fluxonium Qubits in a Flip-Chip Architecture for Analog Quantum Computing

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Fluxonium qubits have proven to be promising candidates for quantum computing applications, due to their remarkably long coherence times [1] and large anharmonicity, without compromising flux tunability. At the half-flux quanta symmetry point, the fluxonium potential resembles a double-well. Here, the ground and first excited states can be expressed as superpositions of persistent current states, which can be utilized as the computational basis. By coupling multiple fluxonium qubits inductively, a transverse interaction between nearest neighbors can be realized, enabling direct mapping of transverse-field Ising models and tight-binding Hamiltonians. To scale such systems, the development of flip-chip architectures has enabled the design of low-crosstalk multi-qubit processors [2]. In this talk, we present the results of QIlimanjaro's first fluxonium 15-qubit flip-chip processor, a blueprint of our technology for analog quantum computing applications.

References

[1] A. Somoroff, Q. Ficheux, R. A. Mencia, H. Xiong, R. Kuzmin, V. E. Manucharyan, Physical Review Letters, 130(26) (2023) 267001

[2] S. Kosen, H.-X. Li, M. Rommel et al., PRX Quantum, 5(3) (2024) 030350

Figures

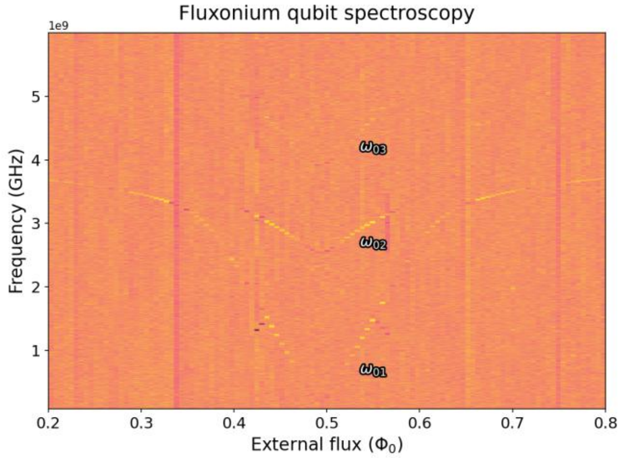

Figure 1: Measurement of a single fluxonium qubit energy spectrum.

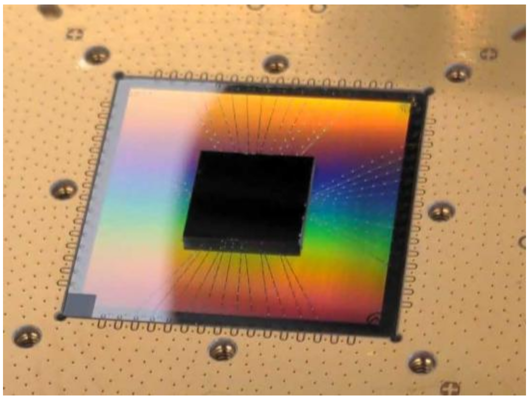

Figure 2: Photograph of a multi-qubit flip-chip device.