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Parallel Two-Qubit Gates on IQM Resonance: Garnet 20-Qubit Quantum Computer

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The promise of quantum computing speeding up the execution of certain computational tasks cannot be achieved without quality hardware. Superconducting qubits are one of the most mature technologies for an implementation of a quantum processing unit (QPU), and such devices are already available to be used by researchers in cloud. Among them is IQM's Garnet QPU available on Resonance platform. This 20-qubit quantum computer represents IQM's core technology choices, such as a floating tunable transmon coupler [1], allowing QPU median CZ gate fidelity of 99.5% and entangling all the qubits on the chip by preparing a GHZ state with 62% fidelity. I will present benchmarking results ranging from fidelities to application benchmarks quantifying performance in certain tasks. Subsequently, I will describe the tunable coupler architecture, and the methods for fast, reliable and automatic calibration of high-fidelity parallel two-qubit gates.
[1] Fabian Marxer et al. PRX Quantum 4 010314 (2023)

Primary author(s) : Dr MROŻEK, Jakub (IQM Quantum Computers)

Co-author(s) : Dr VEPSÄLÄINEN, Antti (IQM Quantum Computers); Dr MARXER, Fabian (IQM Quantum Computers)

Presenter(s) : Dr MROŻEK, Jakub (IQM Quantum Computers)

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