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Tuning the gap of the superconducting flux qubit ARKADY FEDOROV, FLOOR PAAUW, KEES HARMANS, HANS MOOIJ, Kavli Institute of Nanoscience, Delft University of Technology, PO Box 5046, 2600 GA Delft, The Netherland — Recent advances in experiments with the flux qubits include demonstration of single and two qubit quantum gates as well as a coupling between the flux qubit and a harmonic oscillator. It was also experimentally confirmed that the best coherence properties were achieved when the qubit was kept at the symmetry point. For these conditions the qubit's energy level splitting is minimal (the gap) and determined solely by the quantum tunnelling in the double-well potential. However, since the potential barrier and the gap of the conventional flux qubit are fully fixed by the fabrication, one needs to tune the qubit out of the symmetry point in order to bring it in resonance with another quantum system. We overcame this limitation by introducing the change in the qubit design and demonstrated the tuning of the gap over a range of several Gigahertz within a few nanoseconds. We believe this could be an important step toward the coupling of the flux qubit to another qubit or the quantum bus. This control also allows a more extensive study of the relaxation time of the qubit as a function of the gap size within a constant environment.

Arkady Fedorov
Kavli Institute of Nanoscience, Delft University of Technology,
PO Box 5046, 2600 GA Delft, The Netherland

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