Demonstration of a Josephson vortex-based memory cell with microwave energy-efficient readout

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The ongoing progress of superconducting logic systems with Josephson junctions as base elements requires the development of compatible cryogenic memory. Long enough junctions subject to magnetic field host quantum phase 2pi-singularities — Josephson vortices. In this talk we consider the realization of the superconducting memory cell whose state is encoded by the number of present Josephson vortices. This cell was formed by integrating the long Josephson junction into a coplanar resonator. By applying a microwave current with an amplitude much less than the critical current, we can read the number of vortices in the junction in an energy-efficient and non-destructive manner. The memory effect arises due to the presence of the natural edge barrier for Josephson vortices. This talk covers such stages of the research as measurement methodology, description of the results and prospects for improving the developed system.

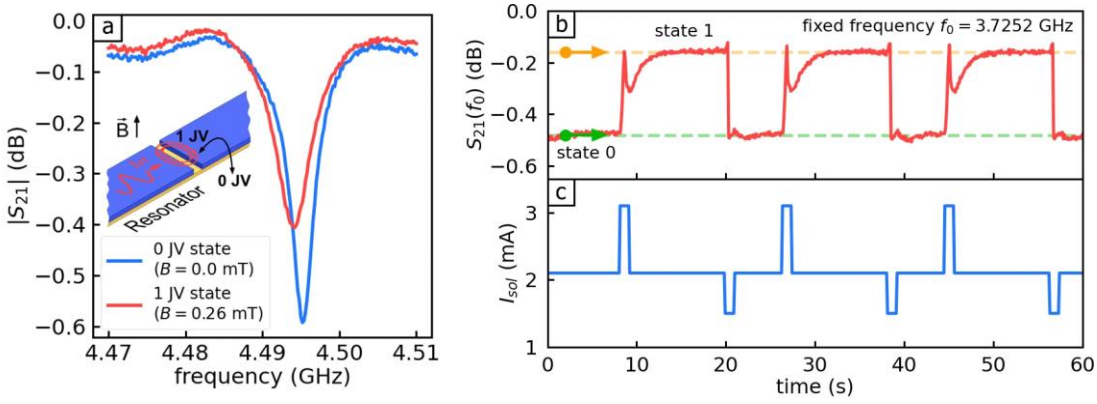

Figure 1. a) resonance modes of the resonator observed as sharp dips in the scattering parameter S21(f) signal at zero-applied magnetic field (blue curve) and at B=0.26 mT (red curve). Inset: a scheme of microwave measurements of JVs; b) experimental demonstration of the switching detection in S21 by applying magnetic field pulses shown in c).

Bibliography:

[1] Kalashnikov, D. S., Ruzhitskiy, V. I., Shishkin, A. G. et al. Demonstration of a Josephson vortex-based memory cell with microwave energy-efficient readout. *Communications Physics*, 7(1), 88 (**2024**).