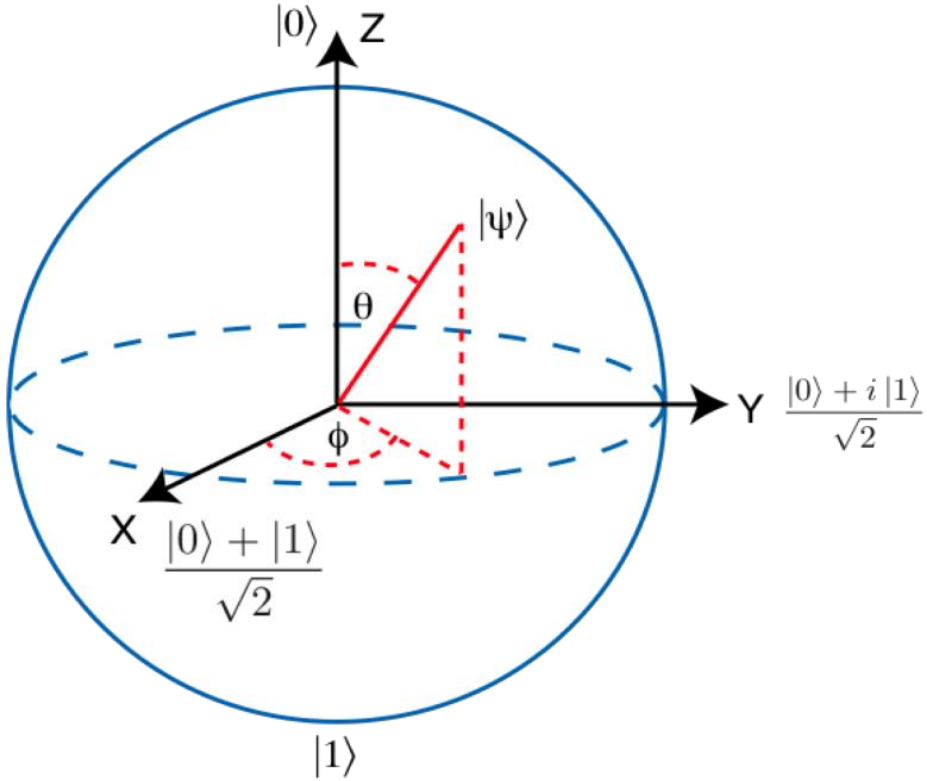
КВАНТОВЫЕ ПРОЦЕССОРЫ НА БАЗЕ СВЕРХПРОВОДЯЩИХ КУБИТОВ

ПЕТРОВА МАРИЯ

НАУЧНЫЙ РУКОВОДИТЕЛЬ: ВАСЕНКО А.С.
PhD, ДОЦЕНТ

КУБИТ



$|0\rangle = 1|0\rangle + 0|1\rangle$ $\quad a|0\rangle + b|1\rangle$

$|1\rangle = 0|0\rangle + 1|1\rangle$ $\quad |a|^2 + |b|^2 = 1$

ГЕЙТ

$$X = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \qquad Y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \qquad Z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$X * |0\rangle = X * (1|0\rangle + 0|1\rangle) = 0|0\rangle + 1|1\rangle = |1\rangle$ $\qquad X * |0\rangle = \begin{pmatrix} b \\ a \end{pmatrix}$

$$CNOT = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{pmatrix}$$

$$CNOT * |10\rangle = CNOT * (0|00\rangle + 0|01\rangle + 1|10\rangle + 0|11\rangle)$$

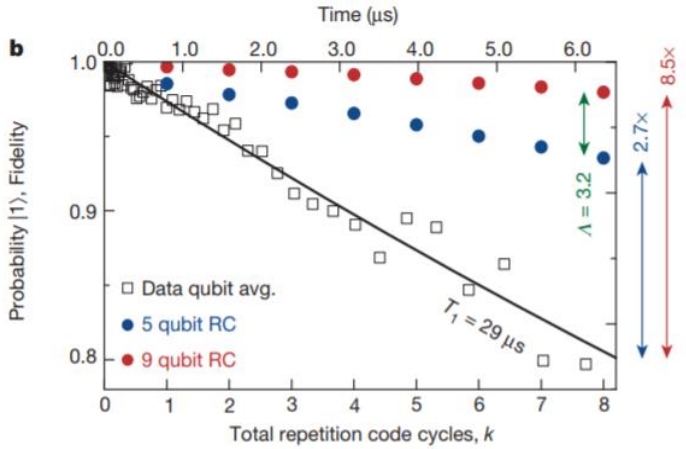
$$= 0|00\rangle + 0|01\rangle + 1|11\rangle + 0|10\rangle = |11\rangle$$

*Quantum Transport. Yuli V. Nazarov, Yaroslav M. Blanter (2002)
*Bloch, Felix "The Principle of Nuclear induction". Phys. Rev. (1946)
*IBM Quantum Experience - quantumexperience.ng.bluemix.net/

*Monroe, C.; Meekhof, D. & King, B. & Itano, W. & Wineland, D. "Demonstration of a Fundamental Quantum Logic Gate". Physical Review Letters (1995)

ПРОЦЕССОР

1



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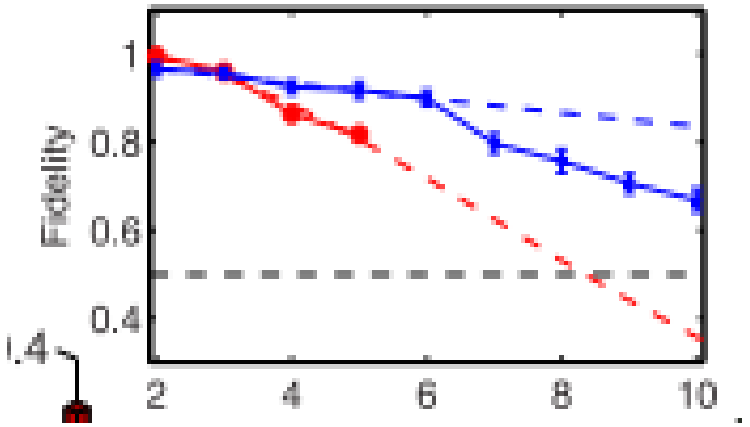
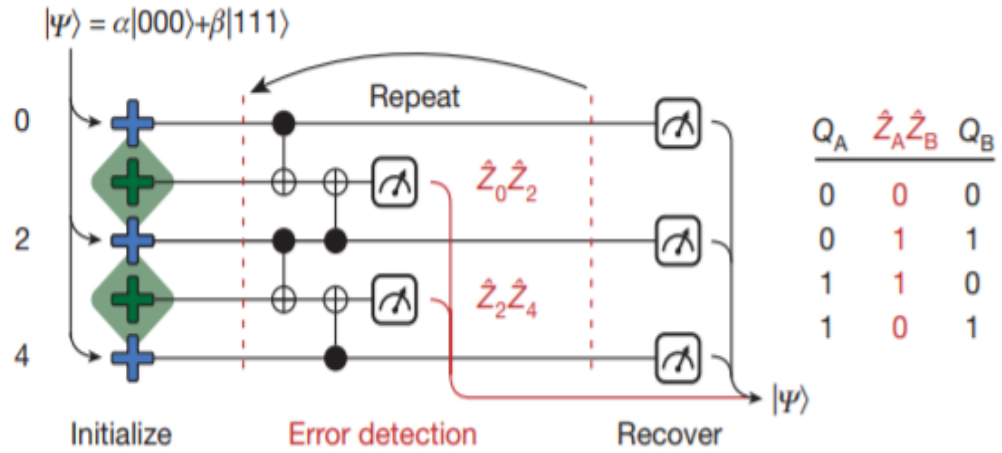
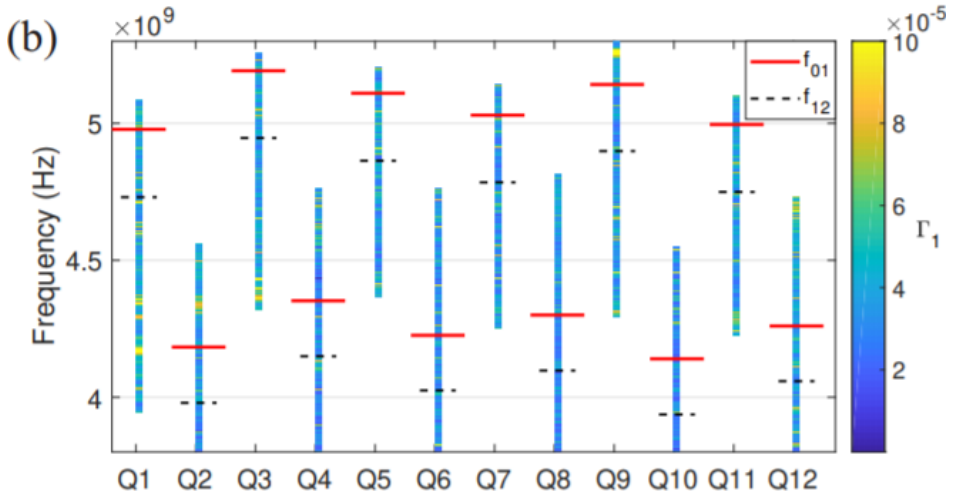




Q_A	$\hat{Z}_A\hat{Z}_B$	Q_B
0	0	0
0	1	1
1	1	0
1	0	1

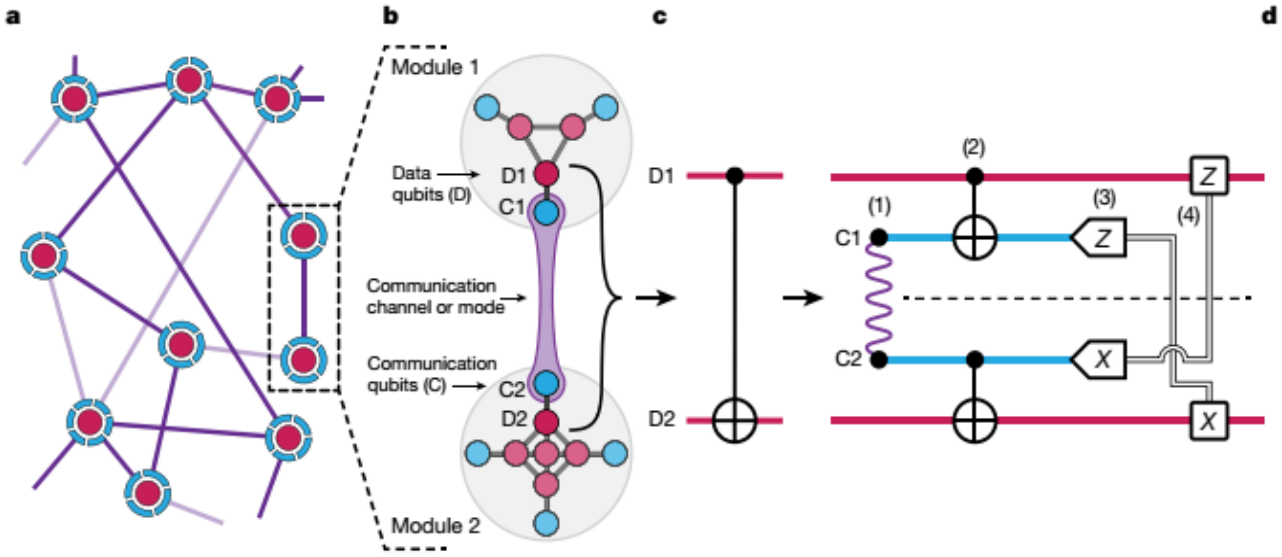
3



*J. Kelly, John M. Martinis et al. State preservation by repetitive error detection in a superconducting quantum circuit. Nature (2014)
*Chao Song et al. "10-Qubit Entanglement and Parallel Logic Operations with a Superconducting Circuit." Physical Review Letters. (2017)
* Ming Gong, Jian-Wei Pan et al. Genuine 12-qubit entanglement on a superconducting quantum processor (Nov 2018)

ШУМ

1



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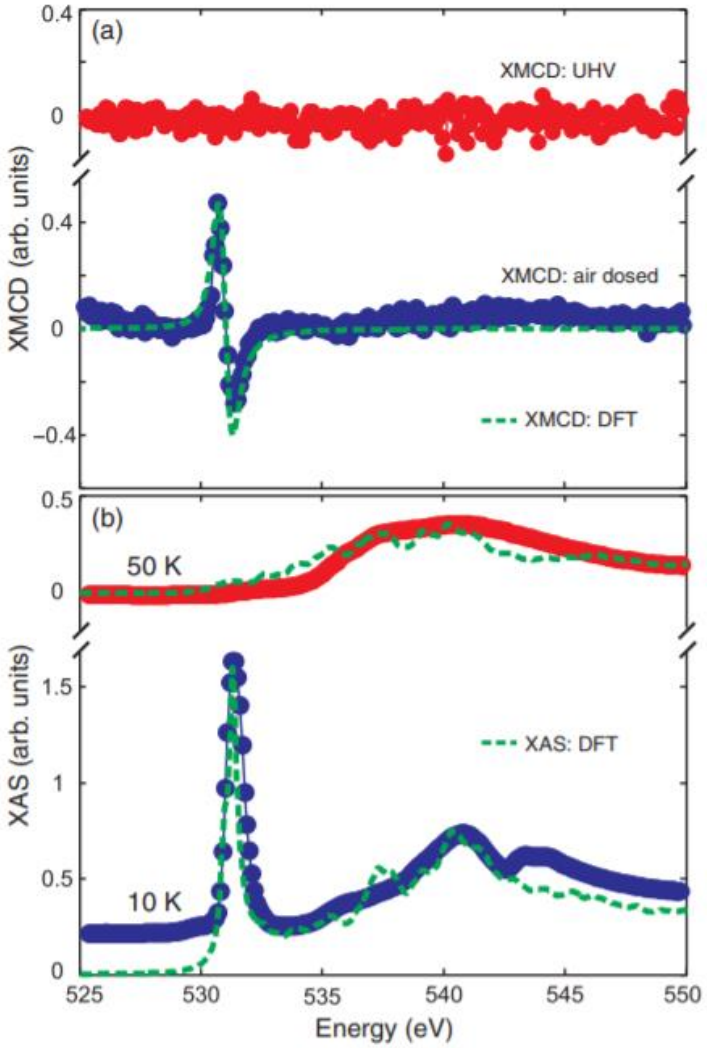
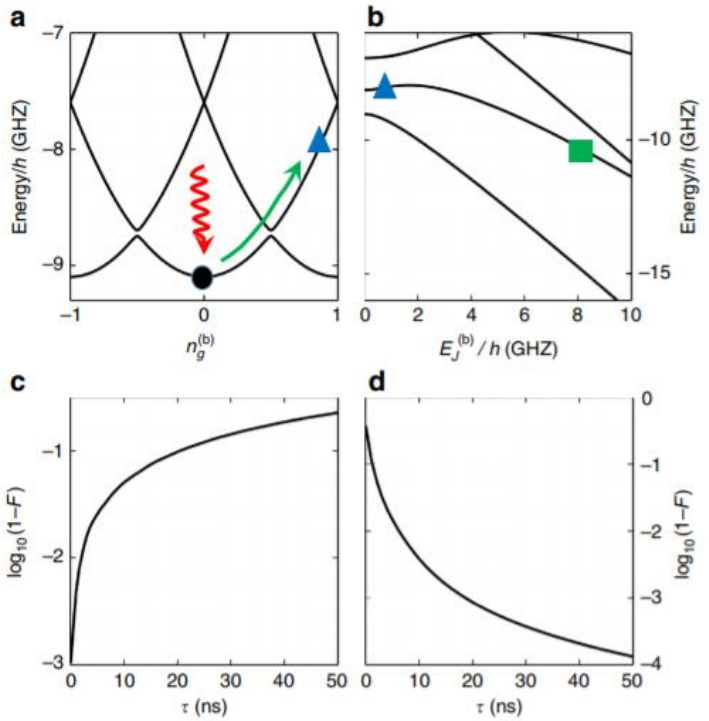


*Kevin S. Chou, R. J. Schoelkopf et al. Deterministic teleportation of a quantum gate between two logical qubits. Nature, (2018)

*P. Kumar et al. Origin and Reduction of 1/f Magnetic Flux Noise in Superconducting Devices, Physical Review Applied (2016)

МЕТОДЫ

1



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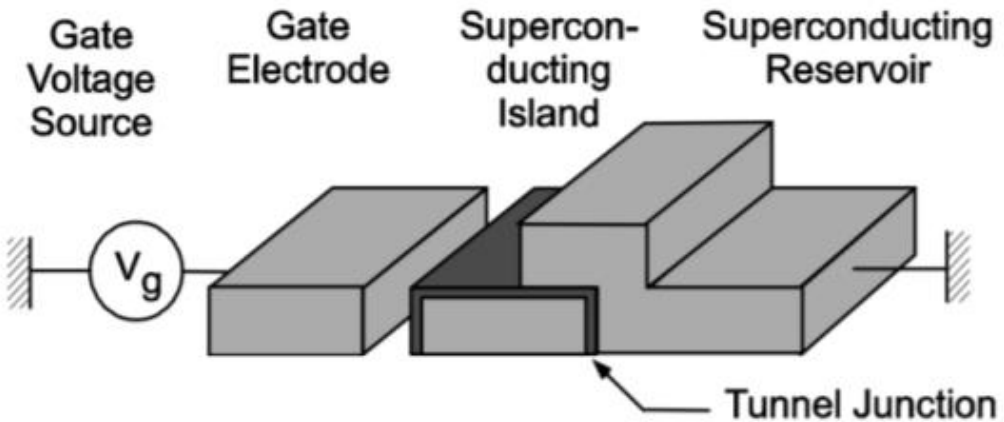

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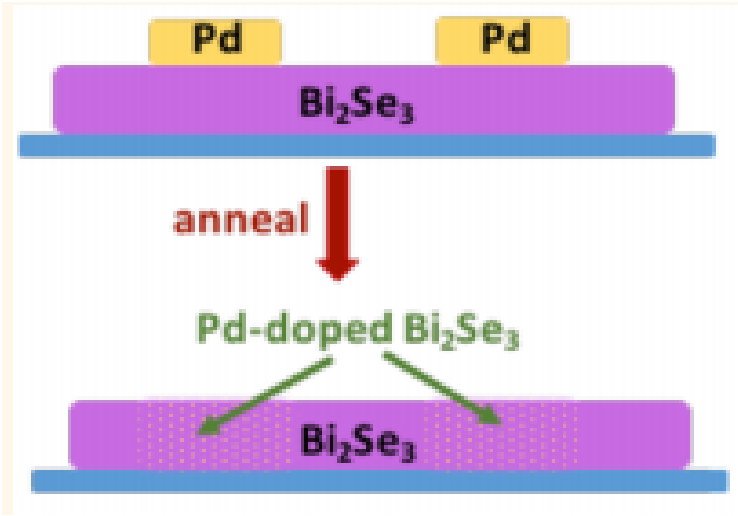

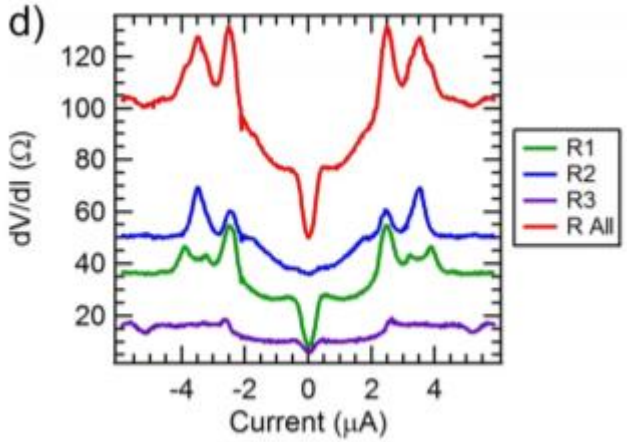

*Yun-Pil Shim et al. Semiconductor-inspired design principles for superconducting quantum computing, Nature Communications (2016)
*J. Majer et al., “Coupling Superconducting Qubits via a Cavity Bus”, Nature (2007)
*Jerome T. Mlack et al, Patterning Superconductivity in a Topological Insulator, ACS Nano (2017)

ТЕНДЕНЦИИ

- ЛИЗИРУЮЩИЕ ПОЗИЦИИ ЗАНИМАЕТ КИТАЙ
- ПРИМЕНЕНИЕ МЕТОДОВ ПОЛУПРОВОДНИКОВ К СВЕРХПРОВОДЯЩИМ СХЕМАМ
- GOOGLE ПРЕЗЕНТОВАЛ КВАНТОВЫЙ ПРОЦЕССОР РАБОТАЮЩИЙ НА 72 КУБИТАХ
- IBM СОЗДАЛА ПЛАТФОРМУ НА КОТОРОЙ МОЖНО СОЗДАВАТЬ КВАНТОВЫЕ АЛГОРИТМЫ
- НОВЫЕ МАТЕРИАЛЫ

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