#18 Circuit/Pulse Optimization Across Different Quantum Hardware Modalities

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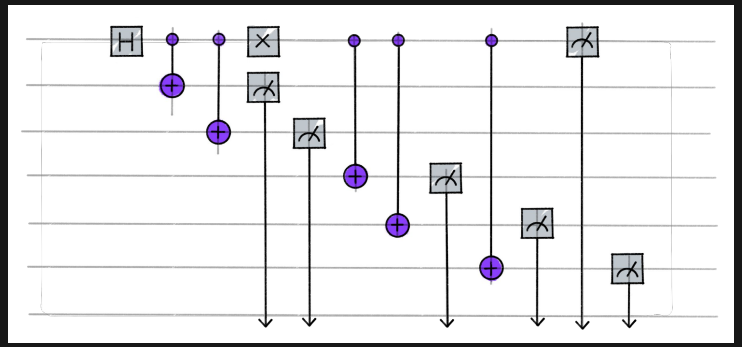
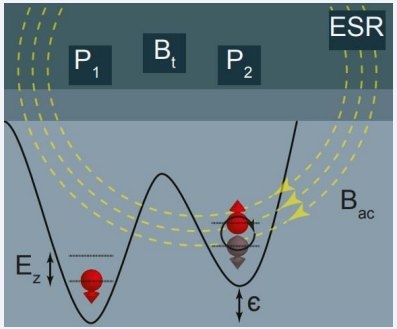
Mentor: Nicholas T. Bronn

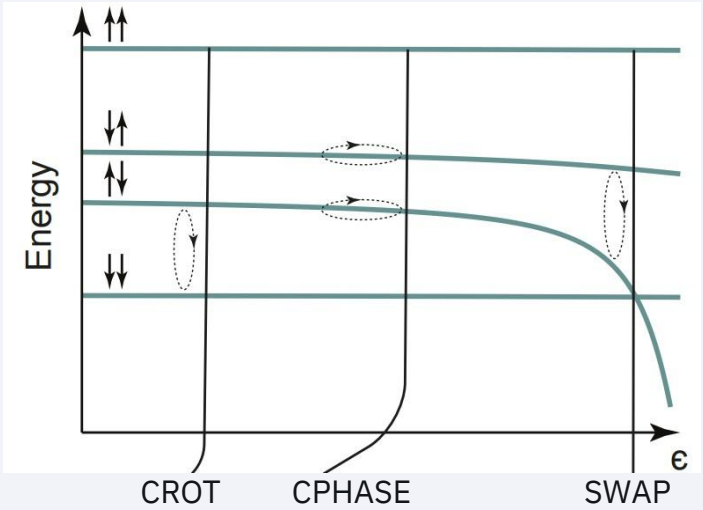


Qiskit

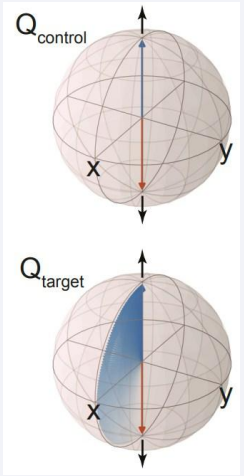
Two-Qubit Gate Implementation on Spin Qubits



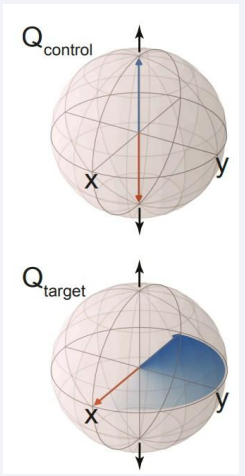
Device geometry



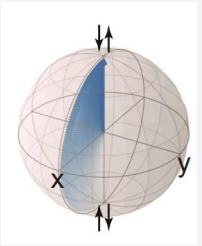
Energy-Detuning Graph



CROT



CPHASE

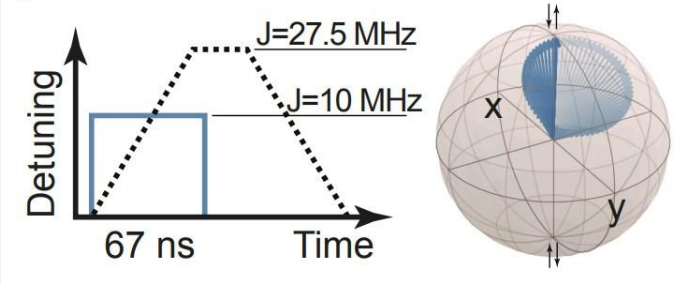


SWAP

$$\hat{H} = \frac{1}{2}\Delta E_z(\epsilon)(\hat{S}_z^1 - \hat{S}_z^2) + J(\epsilon)(\hat{S}^1 \cdot \hat{S}^2 - \frac{1}{4})$$

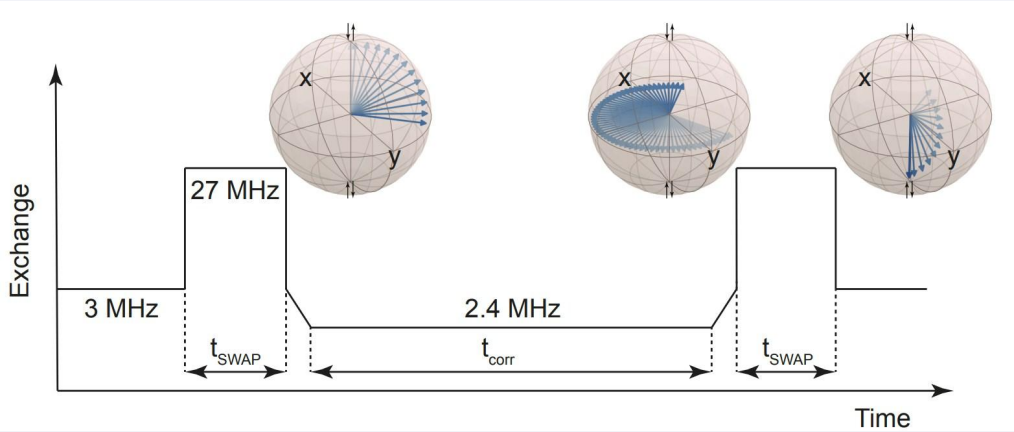
L. Petit et al, arXiv:2007.09034v1

Adiabatic and composite gates



Diabatic and adiabatic CPHASE

$$\hat{H} = \frac{1}{2}\Delta E_z(\epsilon)(\hat{S}_z^1 - \hat{S}_z^2) + J(\epsilon)\hat{S}_z^1\hat{S}_z^2$$



Composite SWAP

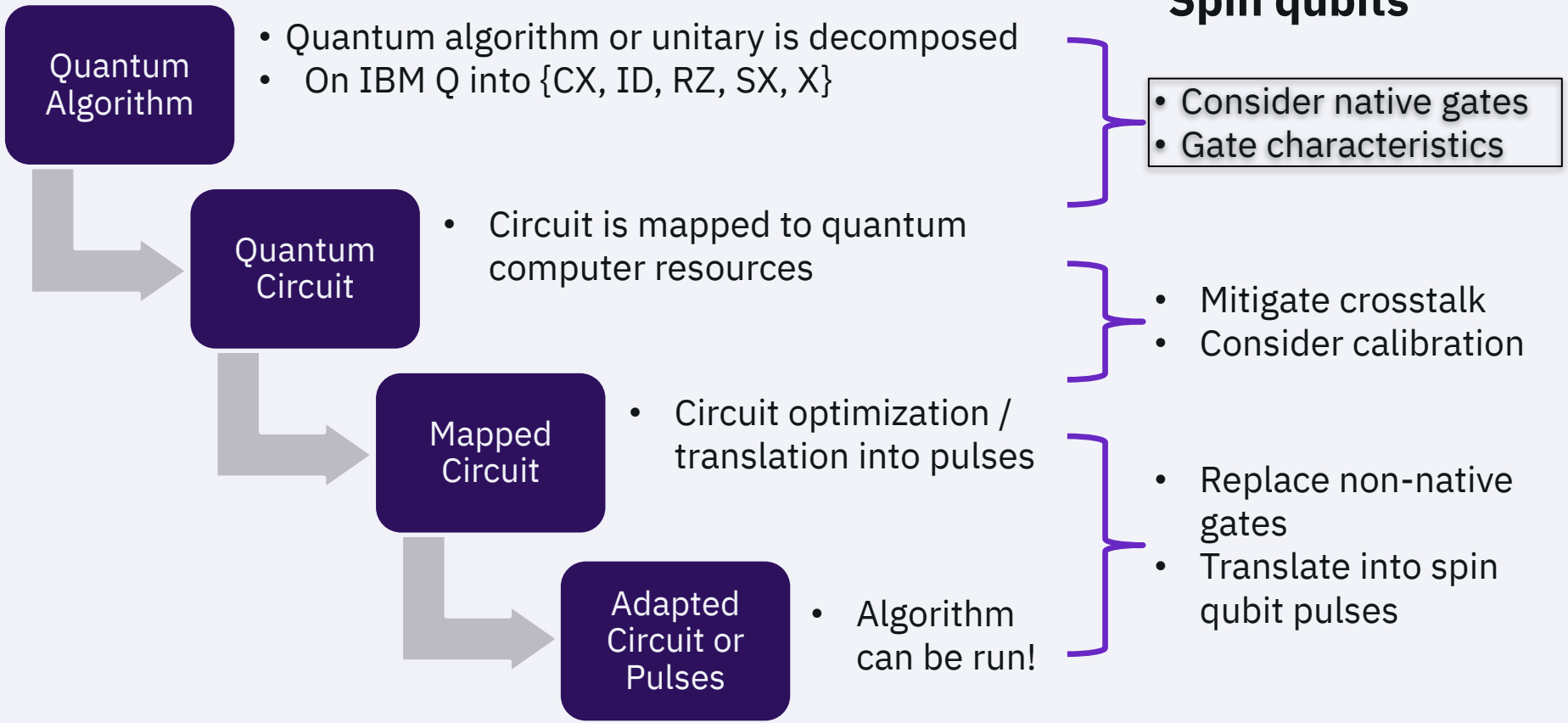
$$\hat{H} = J(\epsilon)(\hat{S}^1 \cdot \hat{S}^2 - \frac{1}{4})$$

$$\hat{H} = \frac{1}{2}\Delta E_z(\epsilon)(\hat{S}_z^1 - \hat{S}_z^2) + J(\epsilon)(\hat{S}^1 \cdot \hat{S}^2 - \frac{1}{4})$$

L. Petit et al, arXiv:2007.09034v1

Quantum Algorithm Computation

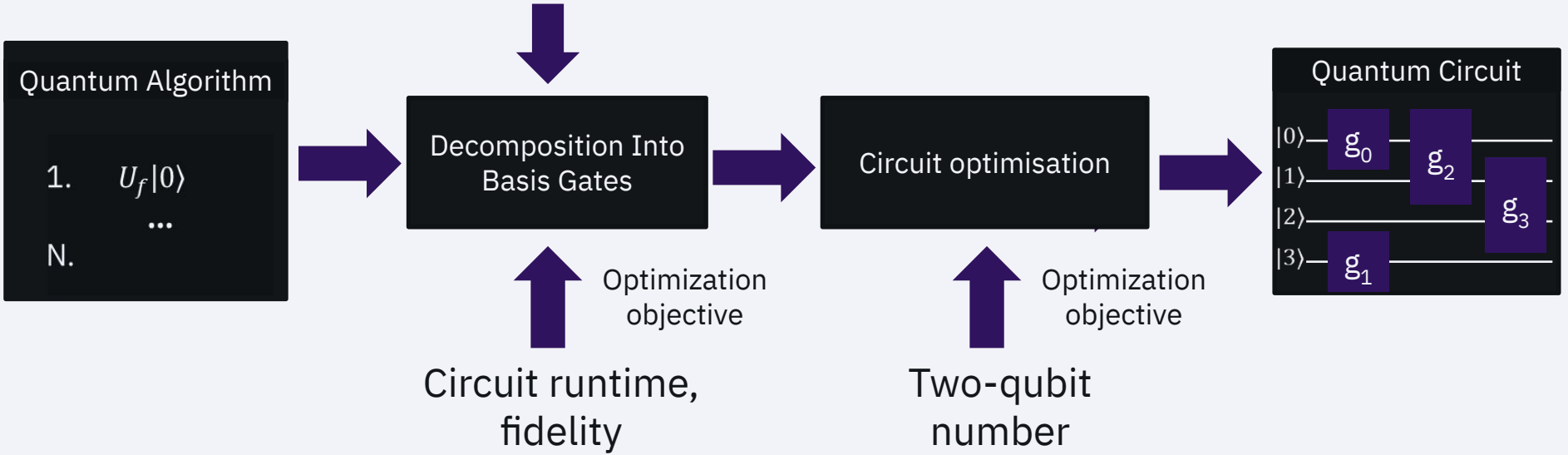
Qiskit



Computing Quantum Algorithms on Spin Qubits

	RZ	RX, RY	CROT	CPHASE	CPHASE-Diabatic	SWAP	SWAP-C
Gate time [ns]	0	~40	660	152	67	19	89
Fidelity	1	0.999	0.994	0.978	0.994	0.842	0.994

Target basis gates



The Team

Qiskit

Mentees

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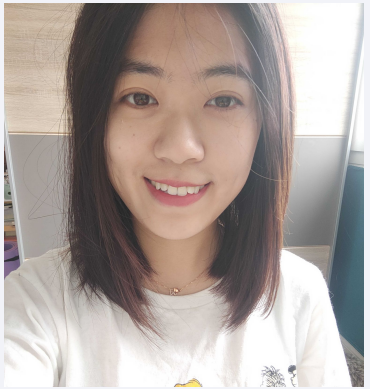

Siyuan Niu

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