

Dark matter search using the direct excitation of transmon qubits ("Quantum computer as DM detector")



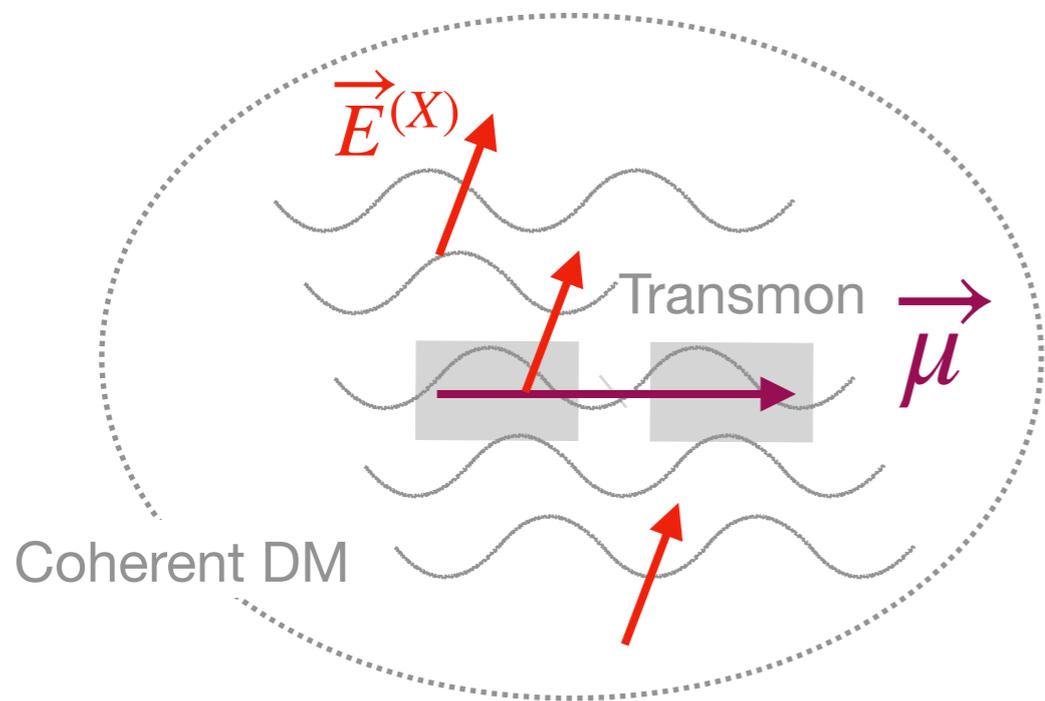
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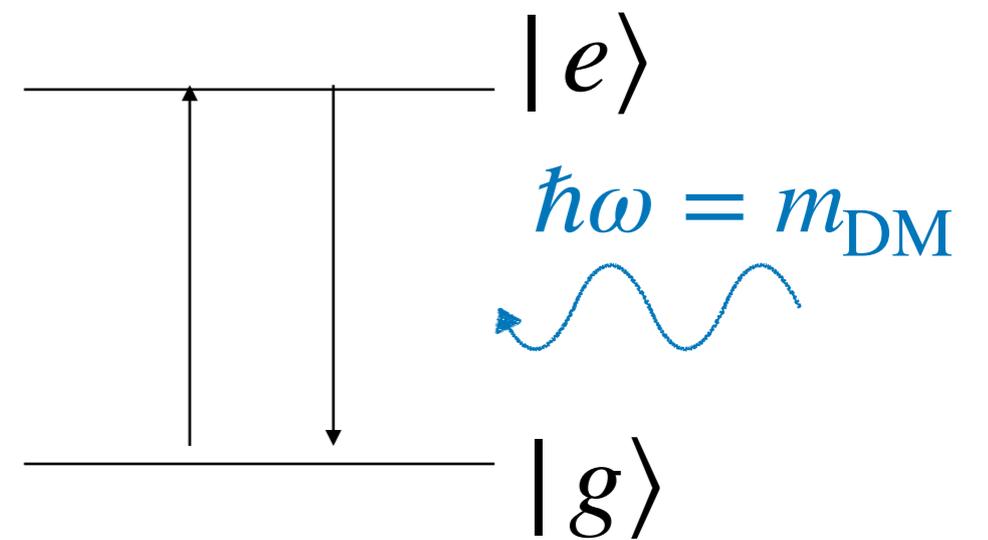
I'll be on-site only from tomorrow.
Shunsuke Adachi will flip through the
slides for me without knowing
what this is about.

Based on arXiv: 2212.03884

E-field from the DM is Qubit drive pulse

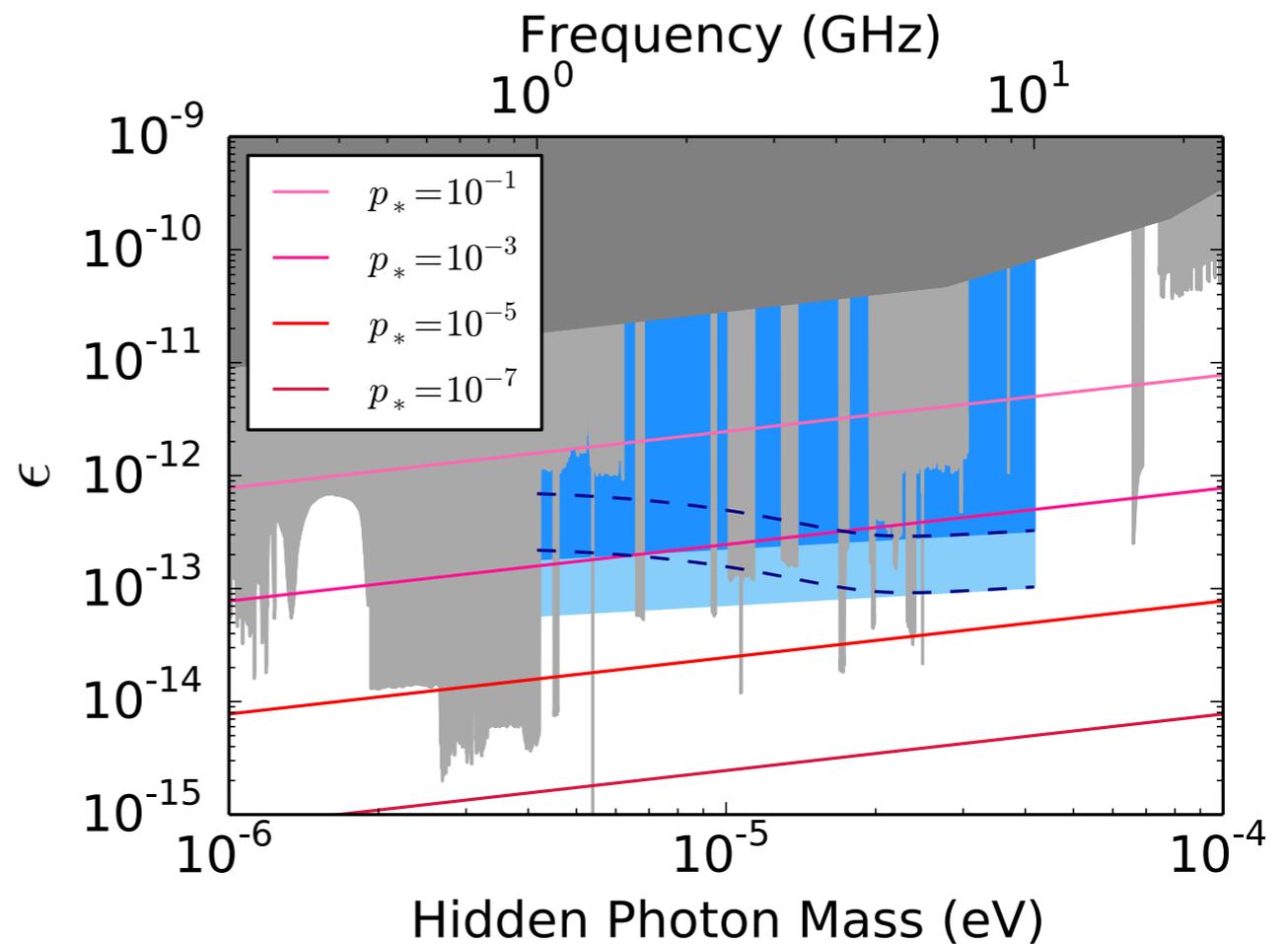
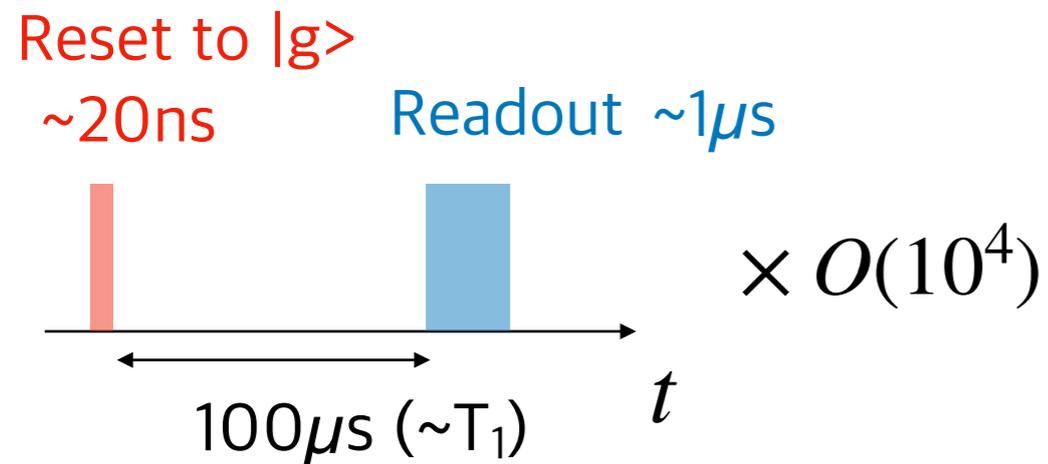


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Excitation rate after τ :

$$p \simeq 0.12 \times \kappa^2 \cos^2 \Theta \left(\frac{\epsilon}{10^{-11}} \right)^2 \left(\frac{f}{1 \text{ GHz}} \right) \left(\frac{\tau}{100 \mu\text{s}} \right)^2 \left(\frac{C}{0.1 \text{ pF}} \right) \left(\frac{d}{100 \mu\text{m}} \right)^2 \left(\frac{\rho_{\text{DM}}}{0.45 \text{ GeV/cc}} \right)$$



- ✓ No SQL
- ✓ Easy freq. tunability with SQUID transmon
- ✓ No penalty at high ω due to the shirking detection vol.
- 😊 $\times 10^{4-6}$ improvement in ϵ can be anticipated by being incorporated in **cavity haloscopes** or **quantum computers**.

Quantum computer is DM detector

max.: a few hour @IBM-Q $N_{\text{try}} \sim O(10^8)$

