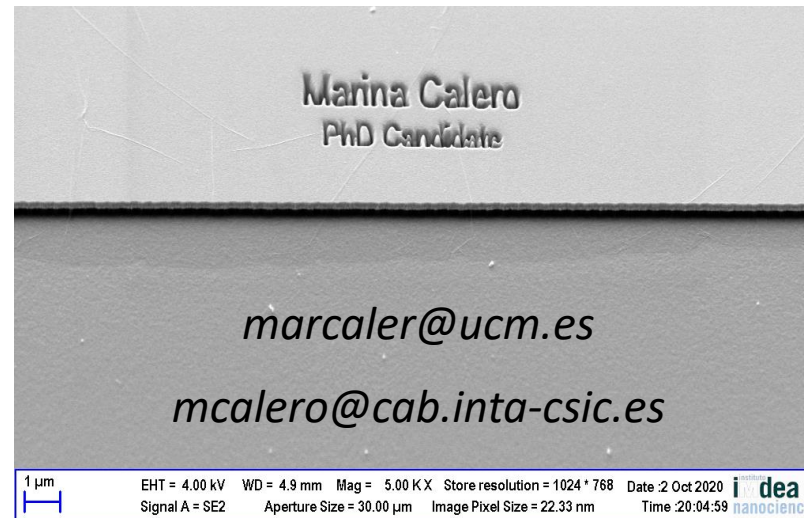


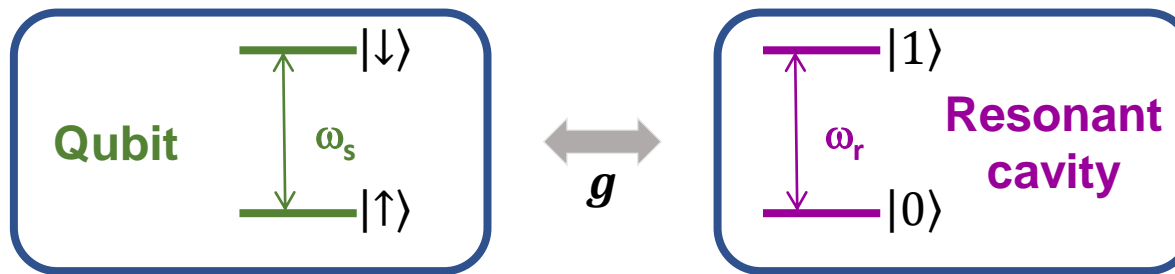
Lumped Element Superconducting Resonators for Quantum Computing with Molecular Spin Qubits



Advisors: Alicia Gómez and Daniel Granados

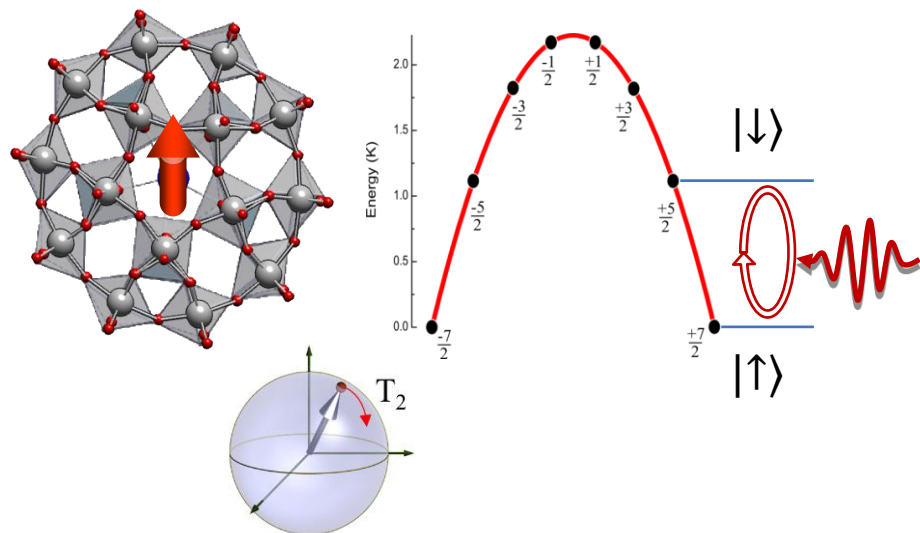
Tutor: Elvira M^a González Herrera

LERs for Molecular Spin Quantum Processor

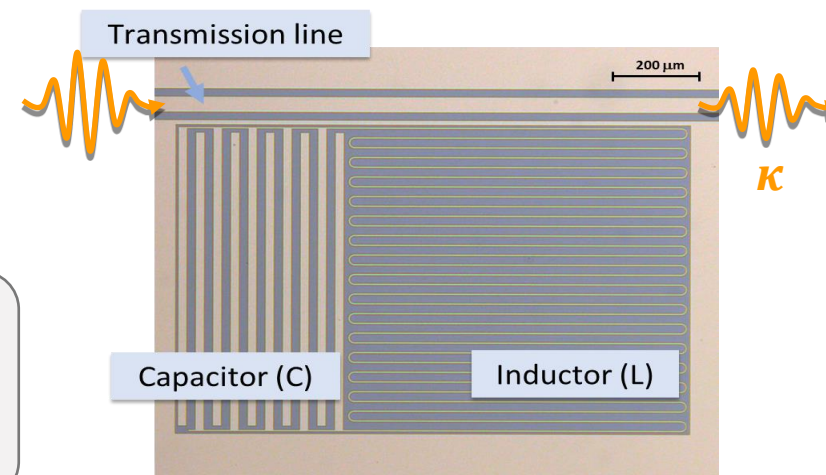


*Hybrid quantum system
on a chip*

Molecular Spin Qubit



Superconducting Lumped Element Resonator (LER)

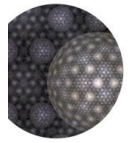


Magnetic coupling

$$g = \sqrt{N} \frac{g_S \mu_B S b_{rf}}{h}$$

Strong coupling regime:

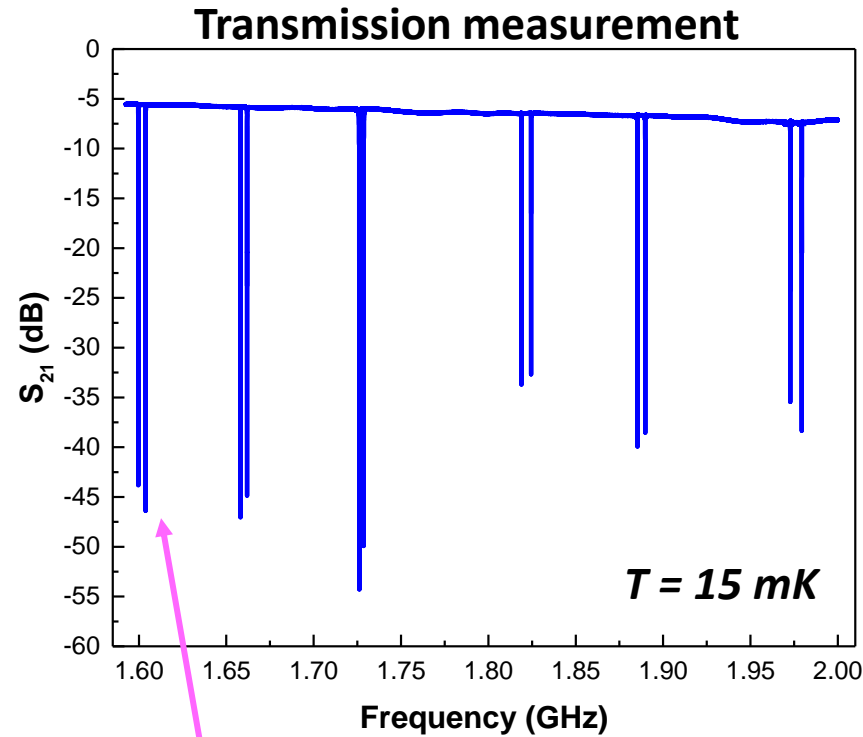
$$g \gg 1/T_{\kappa}, 1/T_2$$



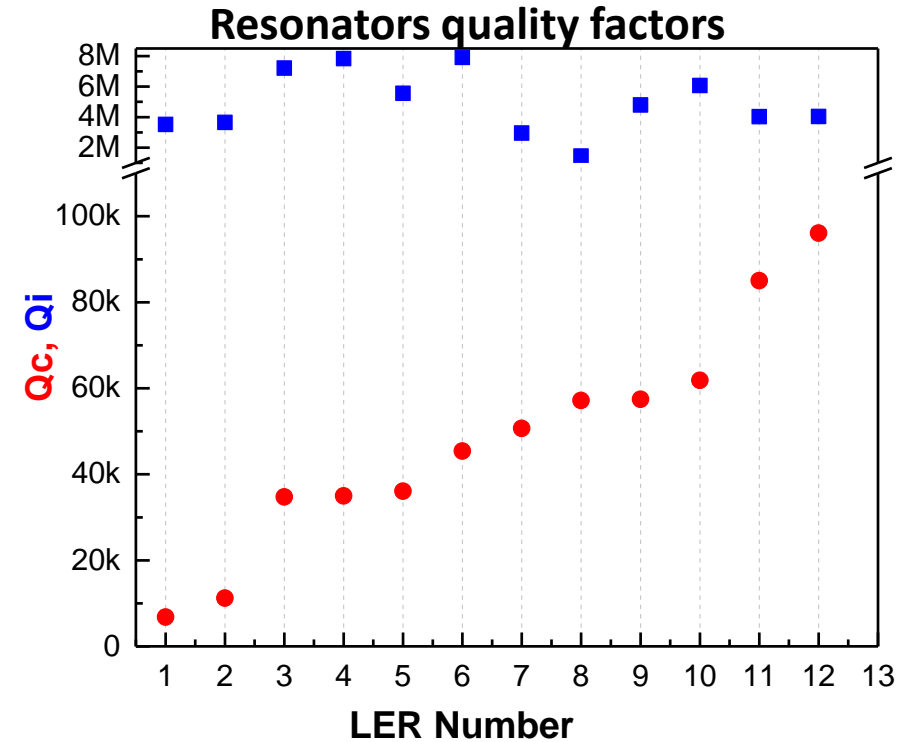
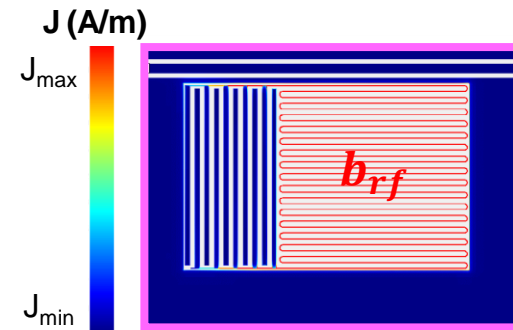
Design and low temperature characterization



T ~ 15 mK

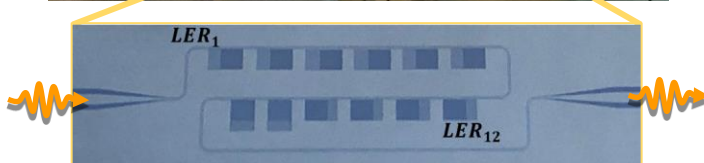


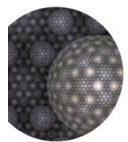
$$\omega_r = \frac{1}{\sqrt{LC}}$$



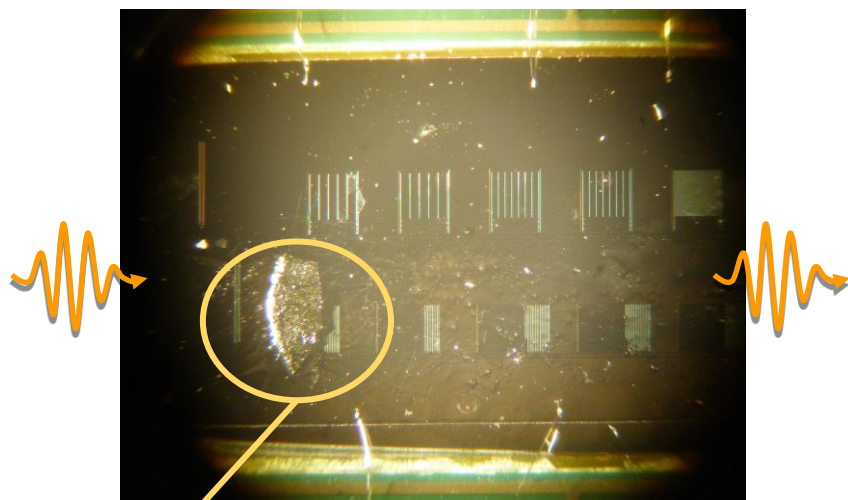
$$Q = \frac{\omega_r}{2\kappa}$$

High-Q niobium LERs
Long Photon Lifetimes



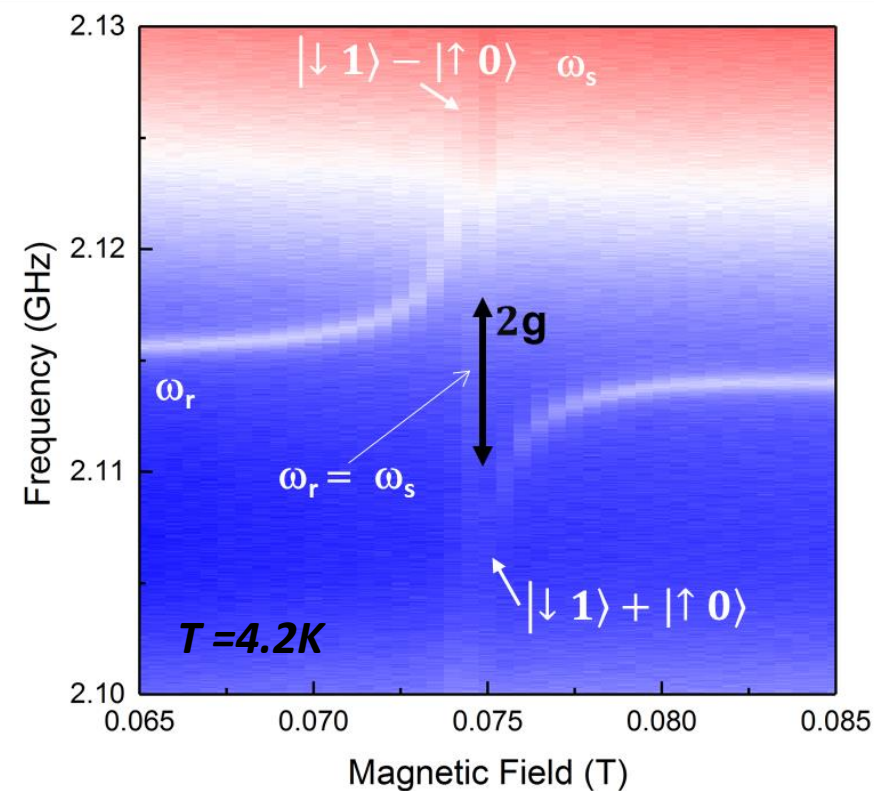
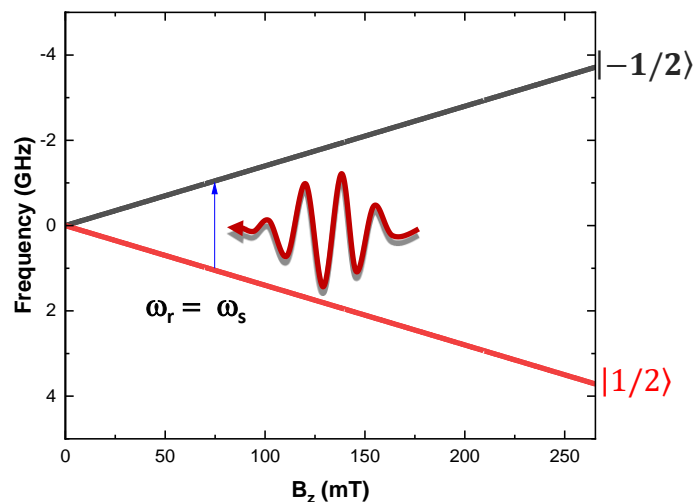


Experimental evidence of strong coupling between magnetic molecules and photons



Magnetic molecule

DPPH
 $S=1/2$



Molecule and photon on resonance
→ Strong Coupling

$$g = 10\text{MHz} > 1/T_K, 1/T_2$$