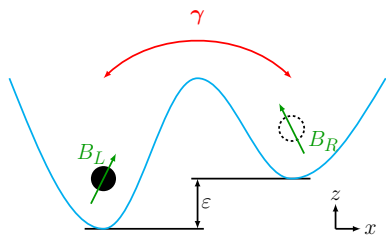
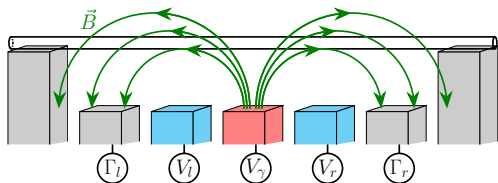


Carbon nanotube based semiconducting quantum computer

Quentin Schaeffer

October 31, 2024

single electron spin qubit



γ : Tunnel rate

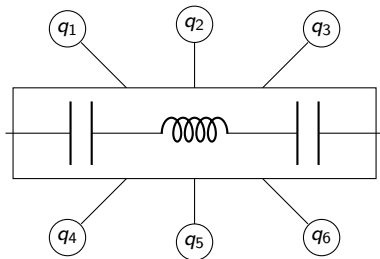
ε : DQD energy bias

$B_L(B_R)$: Magnetic interaction potential

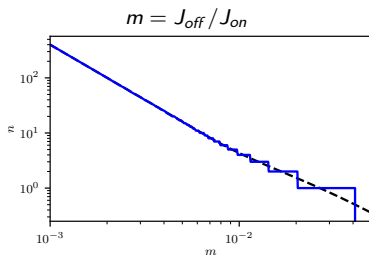
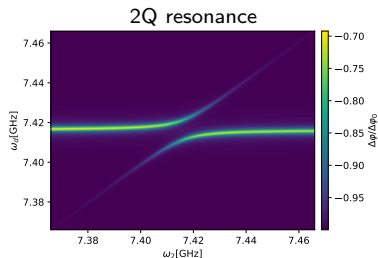
Effective Hamiltonian

$$H = \frac{\varepsilon}{2} \tau_z + \gamma \tau_x + \frac{B_L + B_R}{2} \sigma_z + \frac{B_L - B_R}{2} \sigma_x \tau_z$$

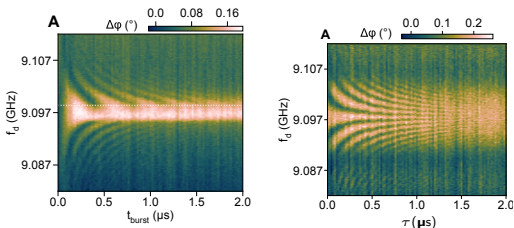
Long range entanglement



$$H = \sum_i \frac{\omega_i}{2} \sigma_z^{(i)} + \sum_{i \neq j} \frac{J_{ij}}{2} (\sigma_-^{(i)} \sigma_+^{(j)} + \sigma_+^{(i)} \sigma_-^{(j)})$$



Highest measured coherence times in cQED semiconductors



at $T = 300\text{mK}$

- ▶ $T_2^* = 1\mu\text{s}$
- ▶ $T_1 = 1\mu\text{s}$
- ▶ $T_\varphi = 2\mu\text{s}$
- ▶ $T_{\text{echo}} = 1.6\mu\text{s}$

High-fidelity radio-frequency charge state readout of ultraclean carbon nanotube quantum dot devices

Rajath Ravichandrar¹, Gordian Fuchs¹, Byron J. Villie¹, Jessica Powell¹, Jithesh Srinivas¹, Pavlos Apostolidis¹, Andreas Baumgartner², Matthieu M. Desjardins³, Takis Kontos⁴, Visa Vesterinen¹, Sławomir Simbierowicz¹, and Mark R. Buitelaar^{1,5}

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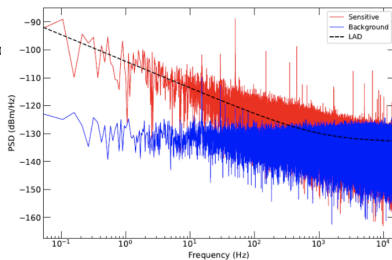
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Noise power spectral density



$$S_0 = 1.8 \times 10^{-2} \mu\text{eV}^2 \text{ Hz}^{-1}$$