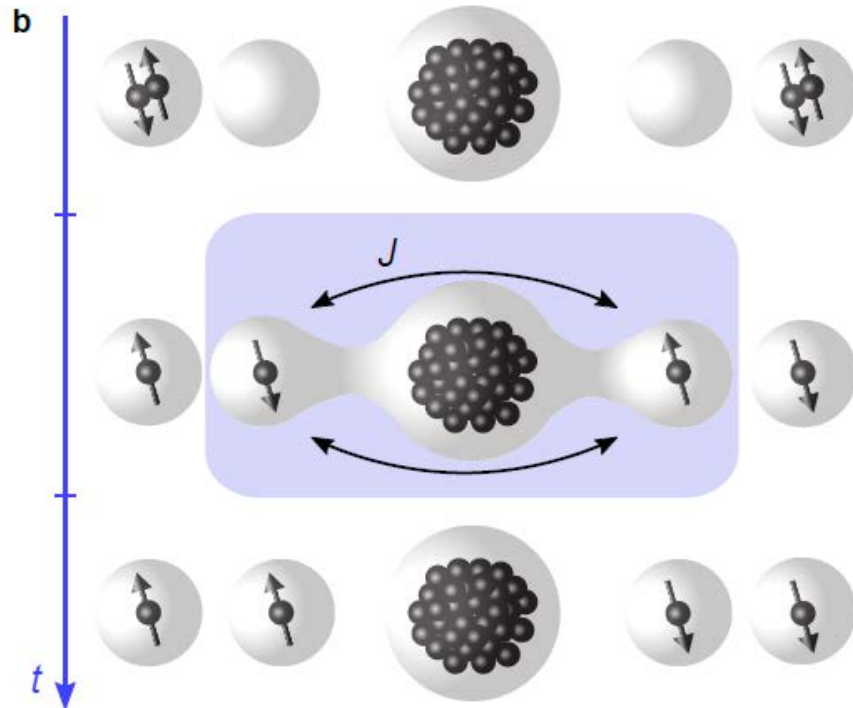
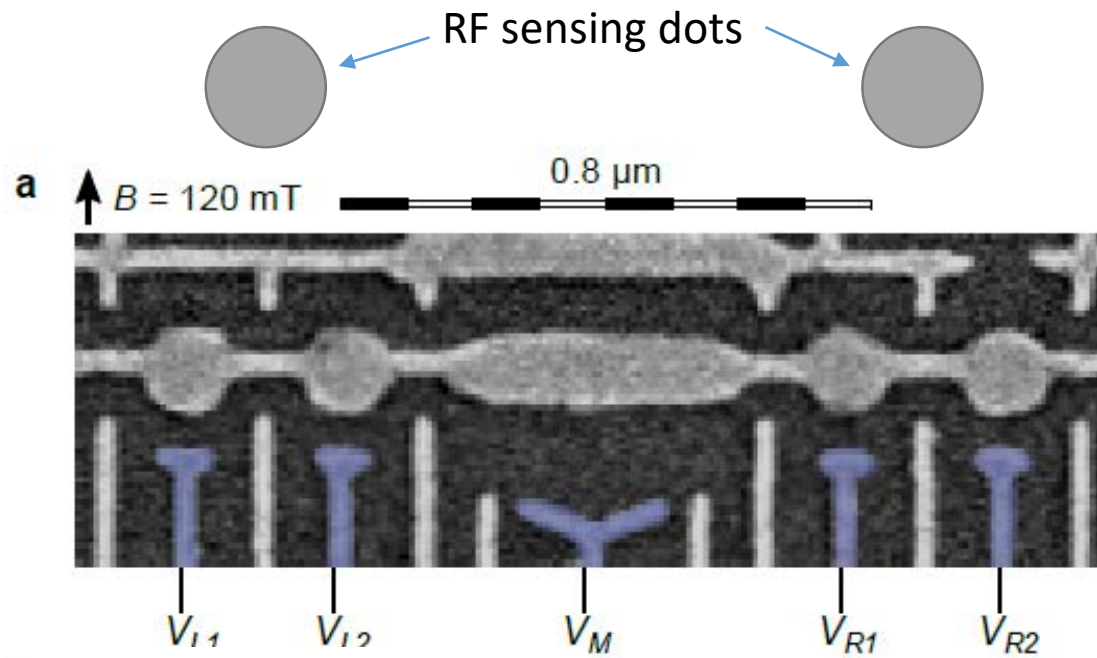
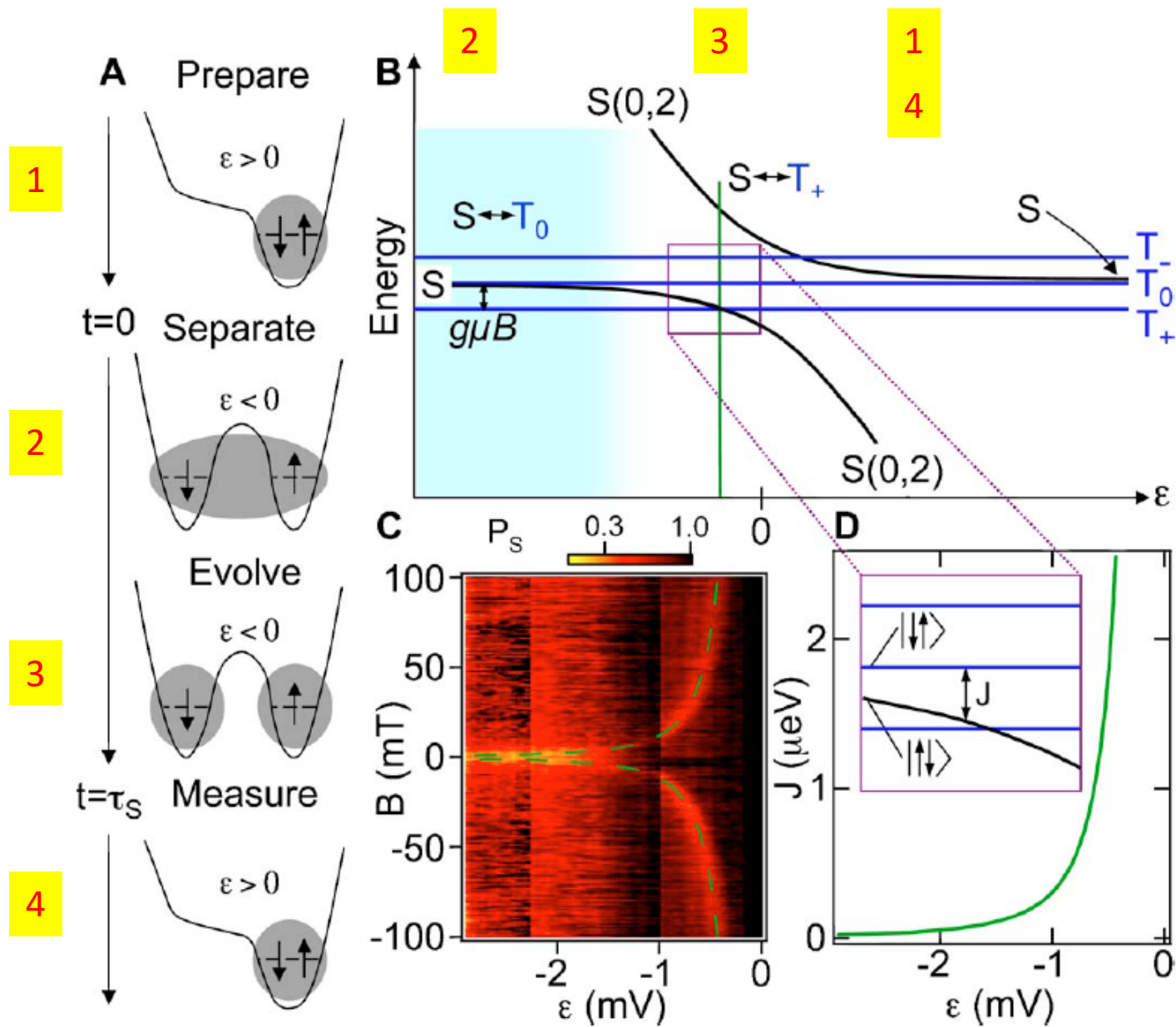


Fast spin exchange between two distant quantum dots

Malinowski et al.

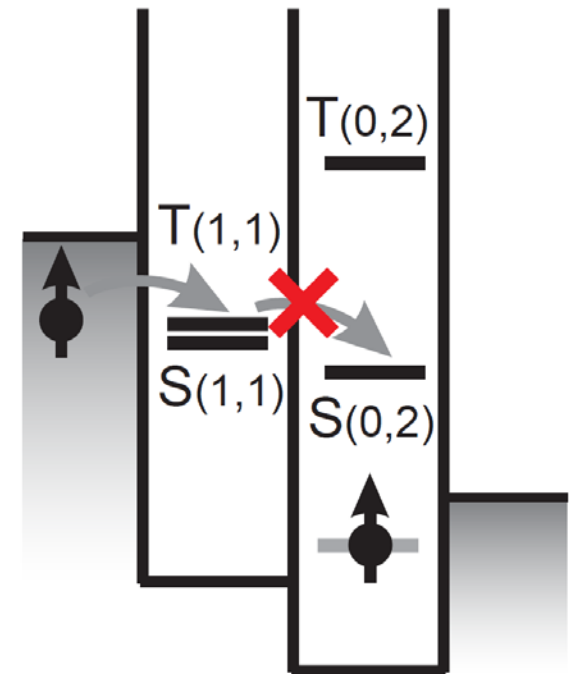


- GaAs/AlGaAs heterostructure (mobility $2.3 \times 10^6 \text{ cm}^2/\text{Vs}$, depth 57 nm)
- 10 nm HfO_2 below gates
- In-plane B-field of 120 mT
- 2 RF sensing QDs
- Two DQDs with two electrons each
- Large dot occupied by EVEN # of 50-100 electrons



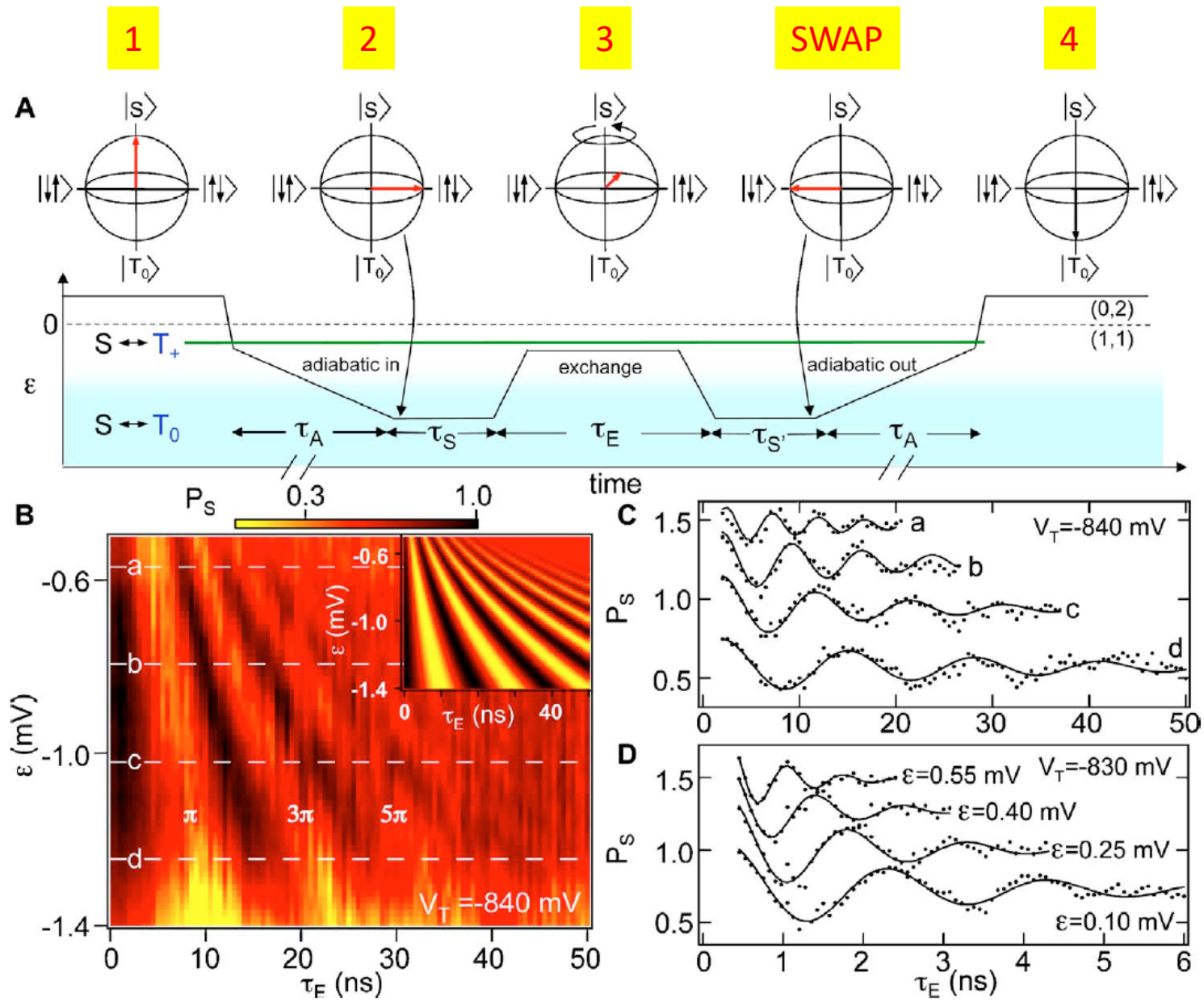
In $|S\rangle, |T_0\rangle$ basis:

$$H = \begin{pmatrix} -J(\varepsilon) & g\mu_B\Delta B_{N,z} \\ g\mu_B\Delta B_{N,z} & 0 \end{pmatrix}$$



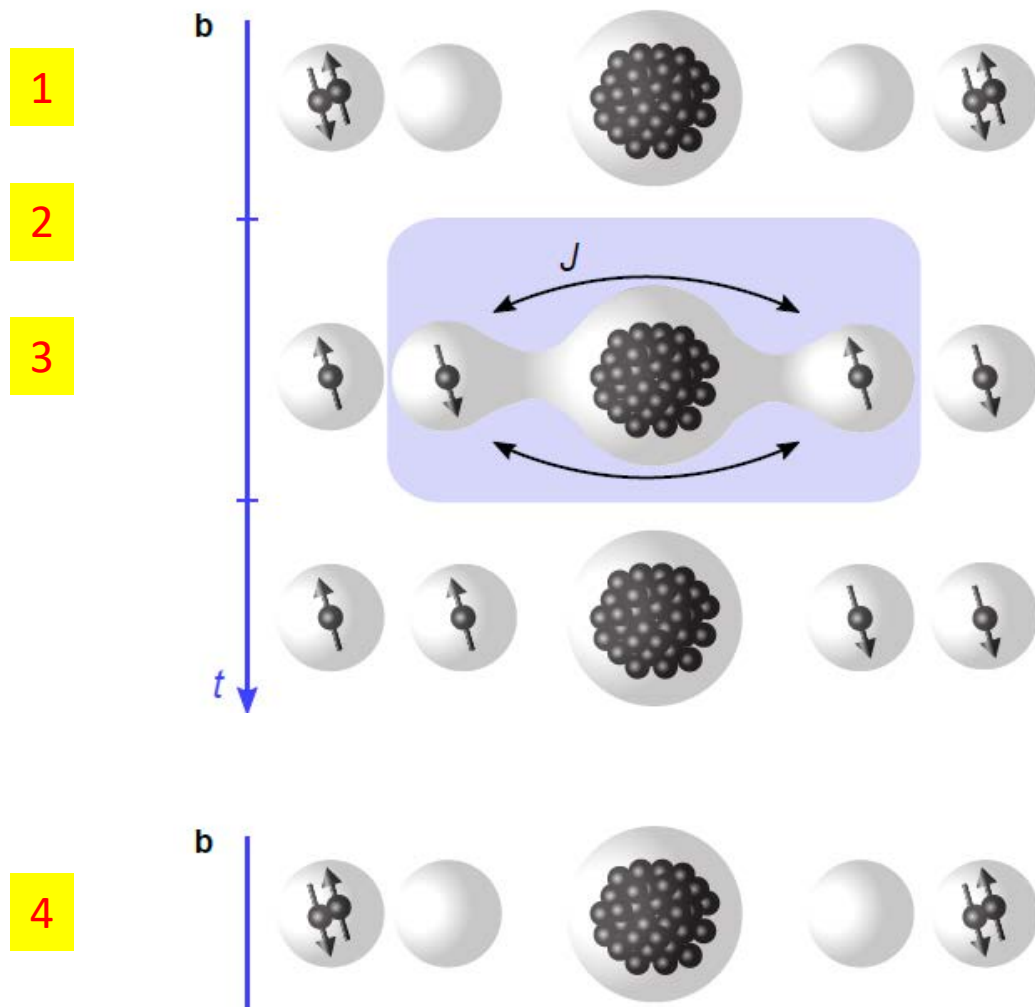
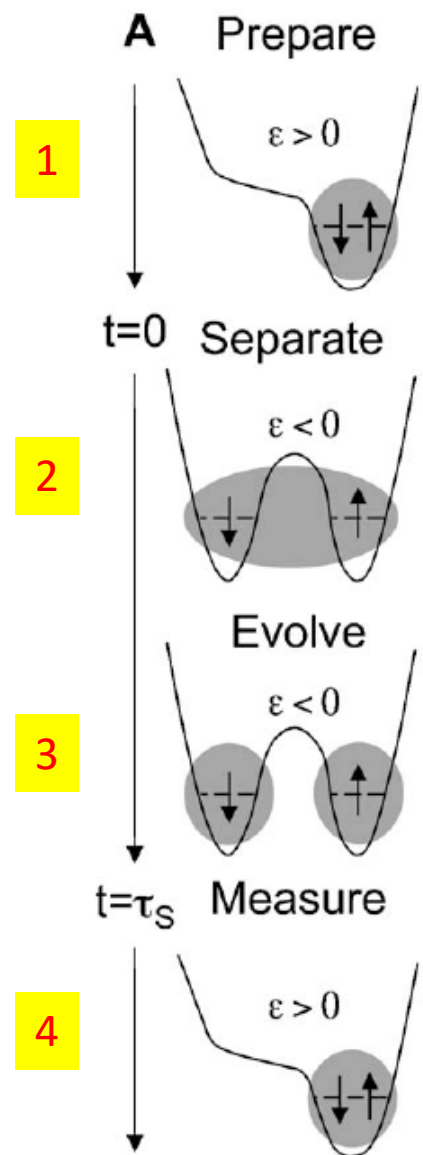
Petta et al. Science (2005)

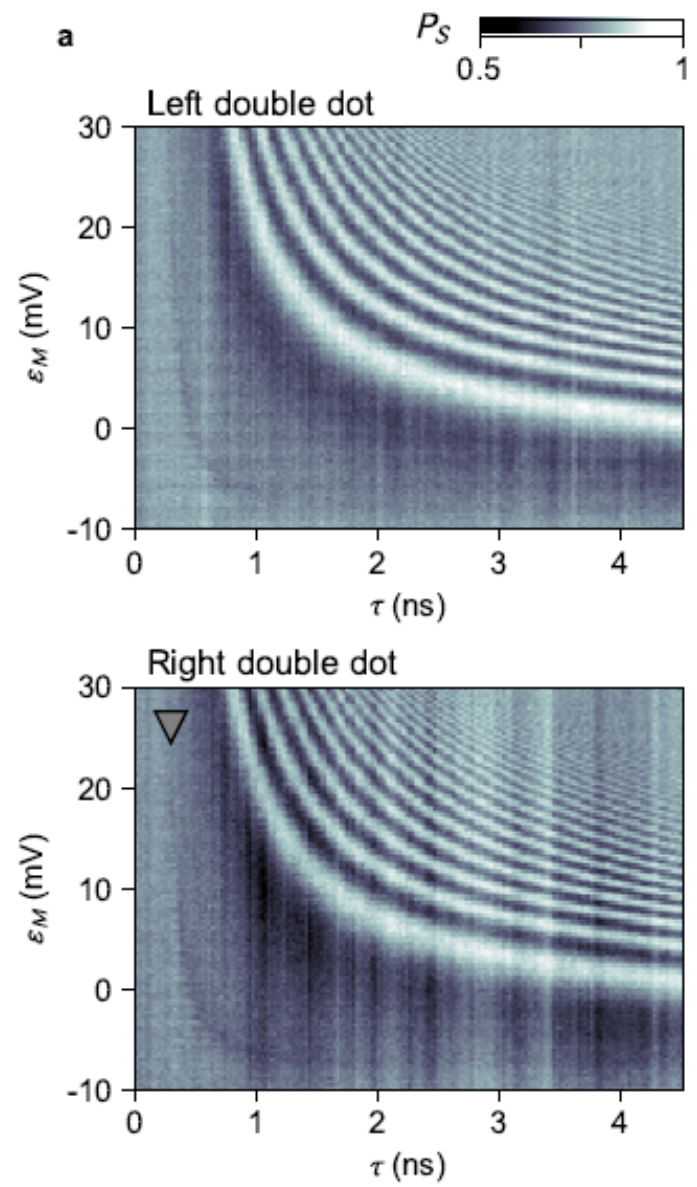
Hanson et al. Rev. Mod. Phys. (2007)

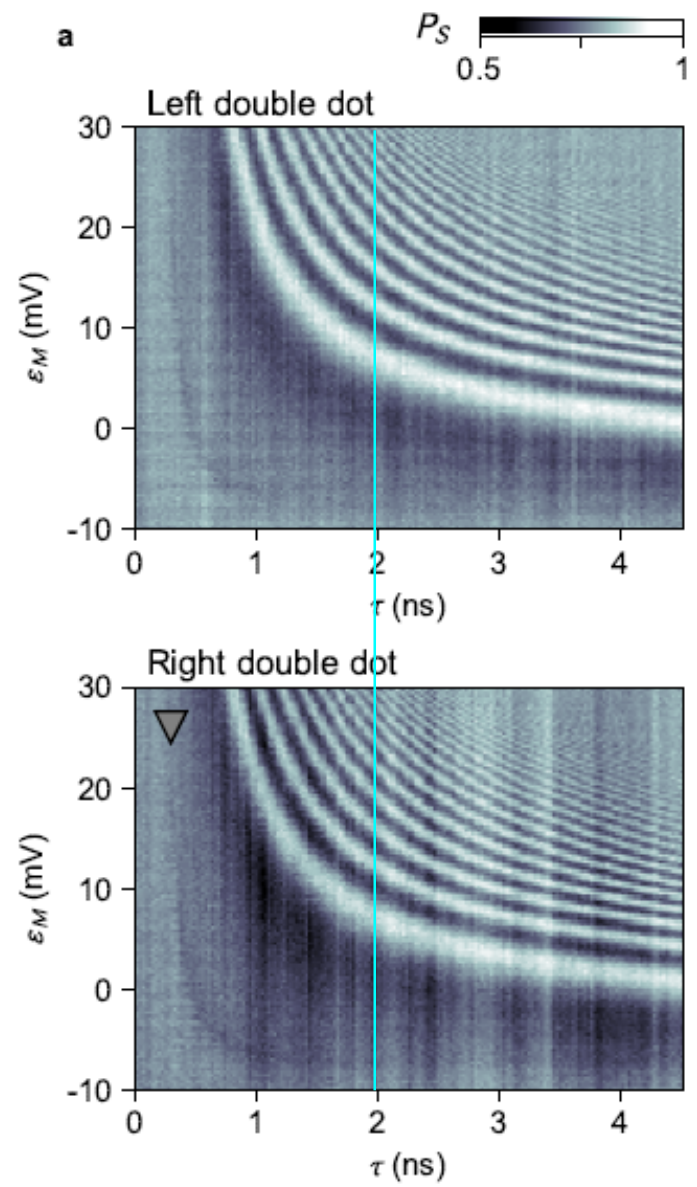


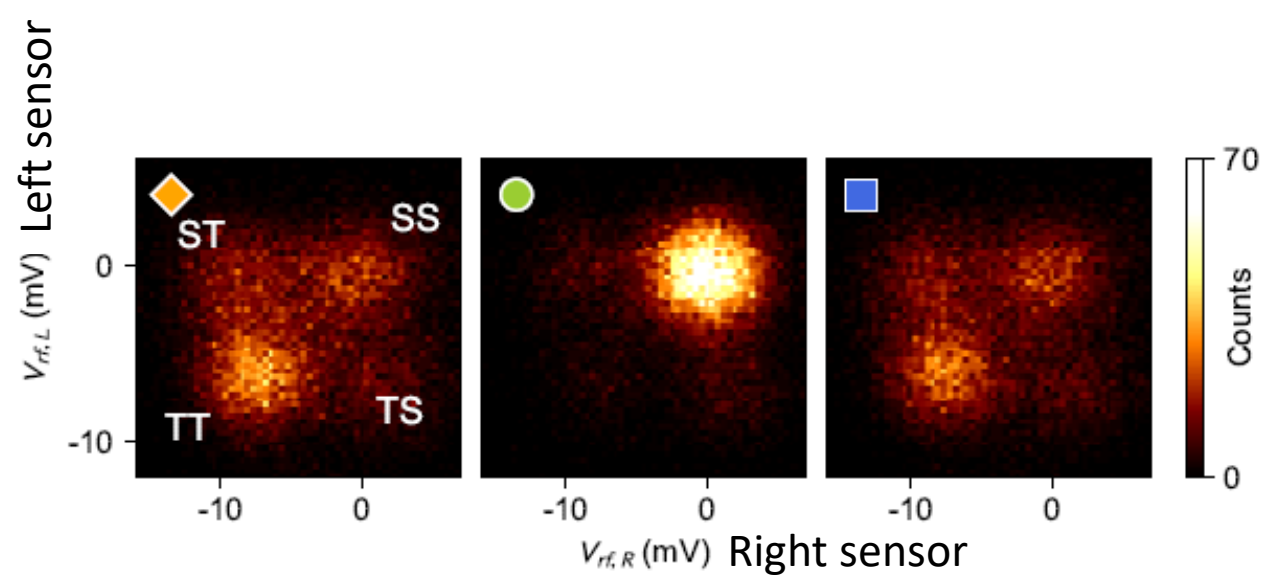
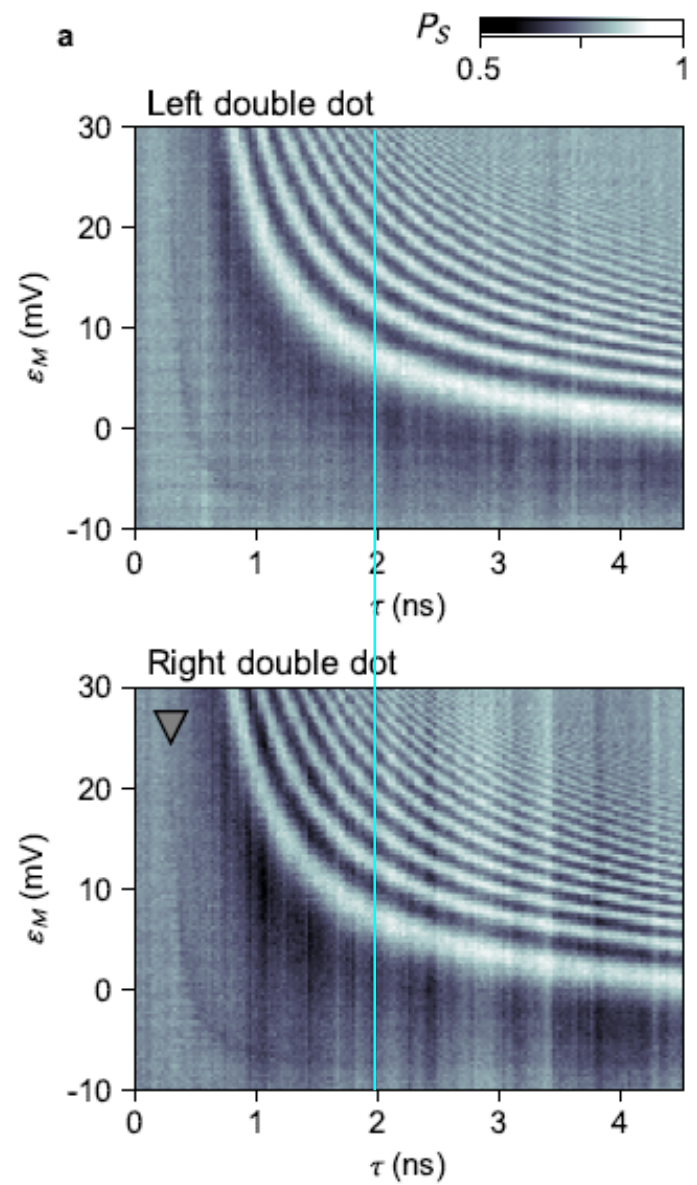
Petta et al. Science (2005)

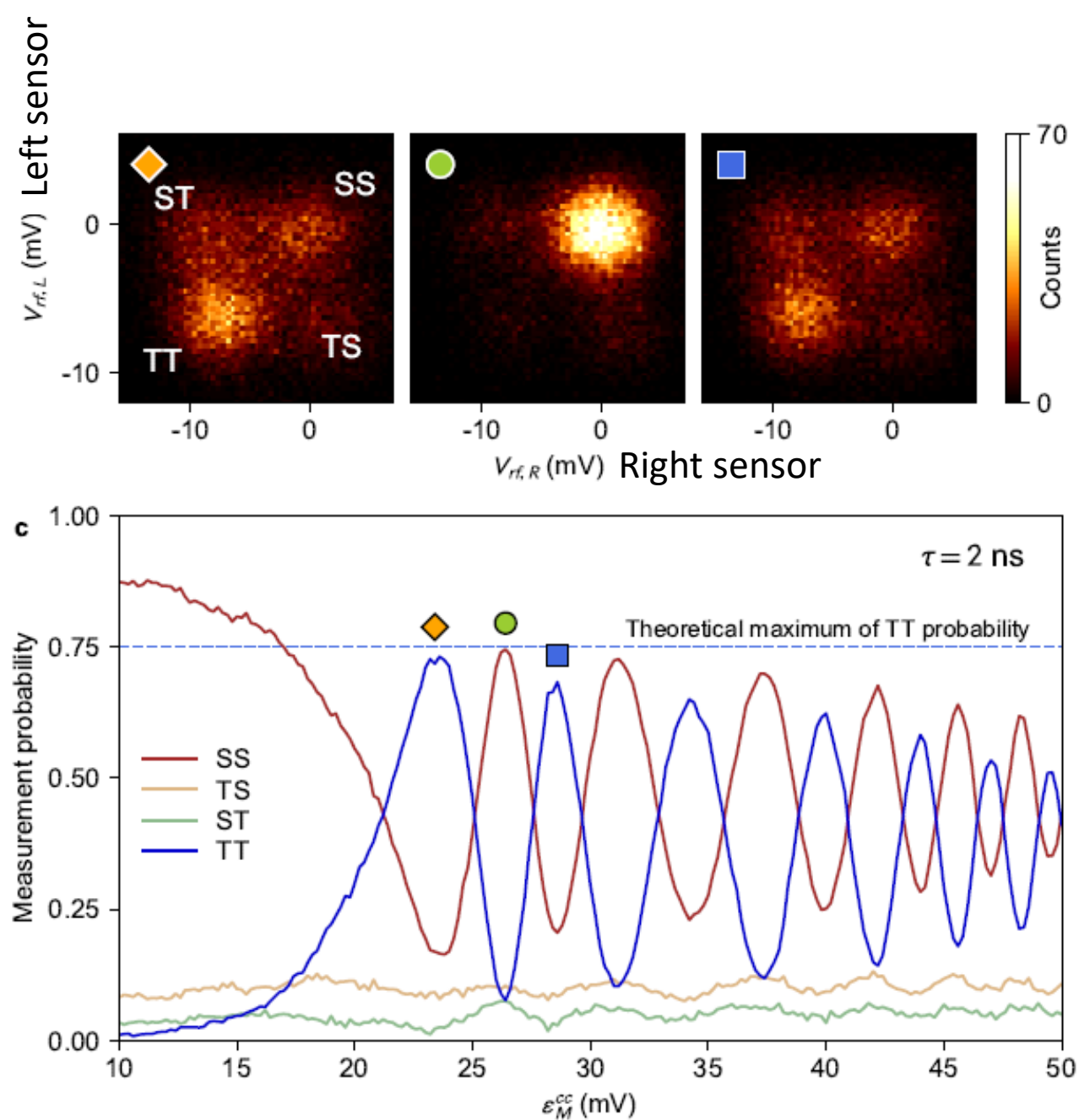
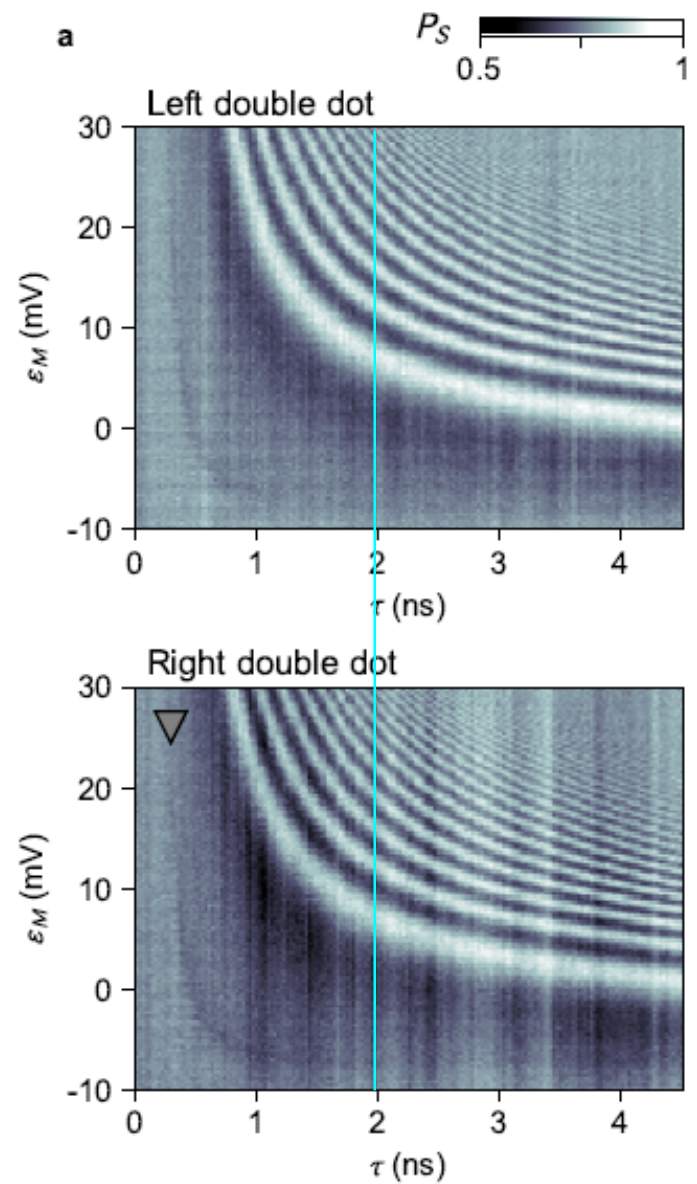
Hanson et al. Rev. Mod. Phys. (2007)

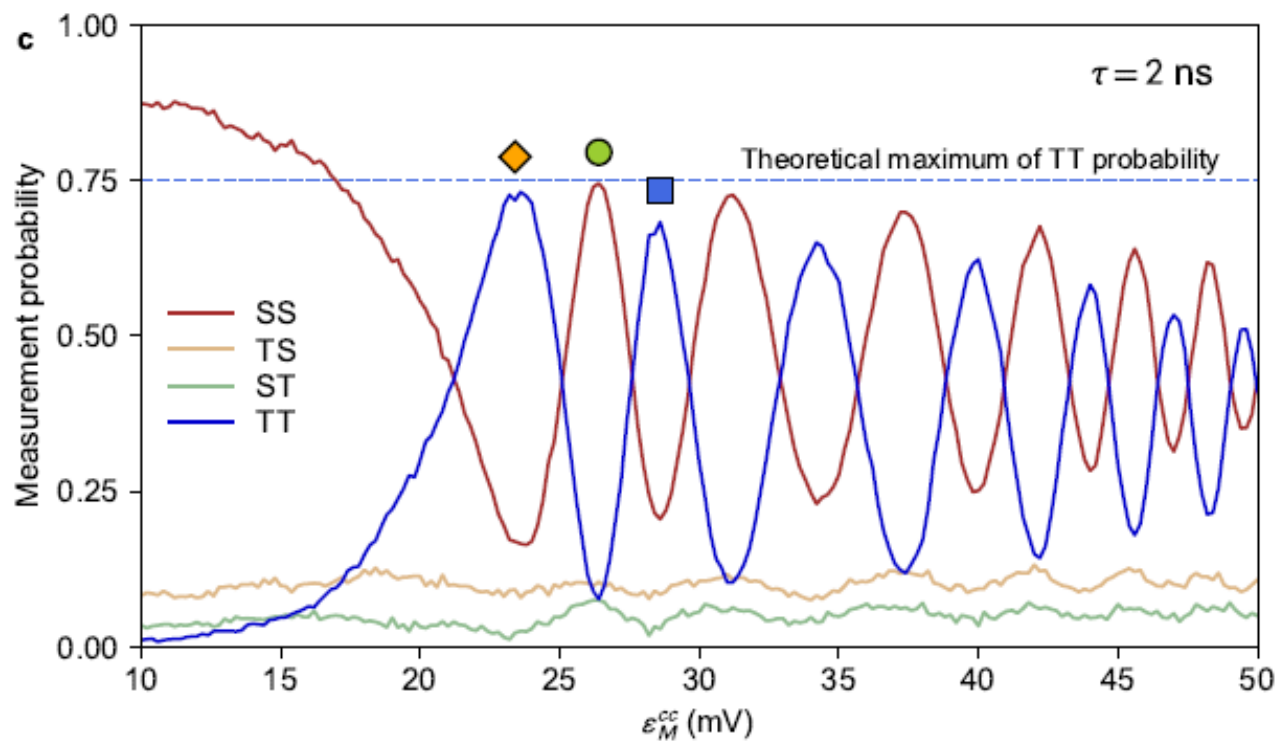
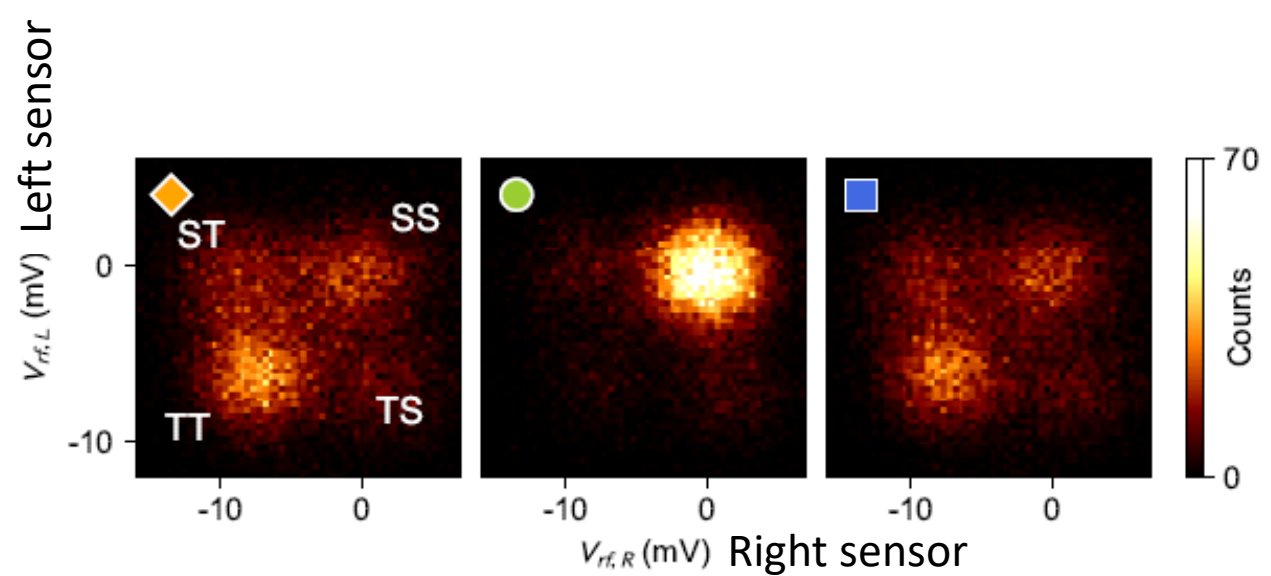
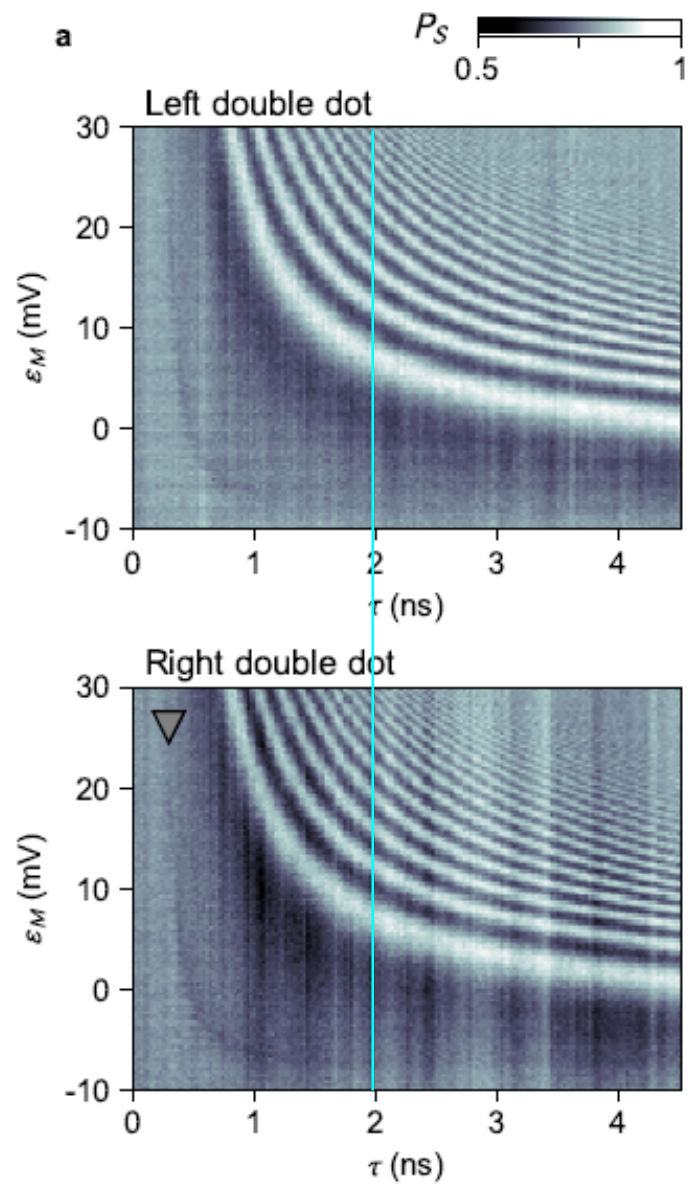






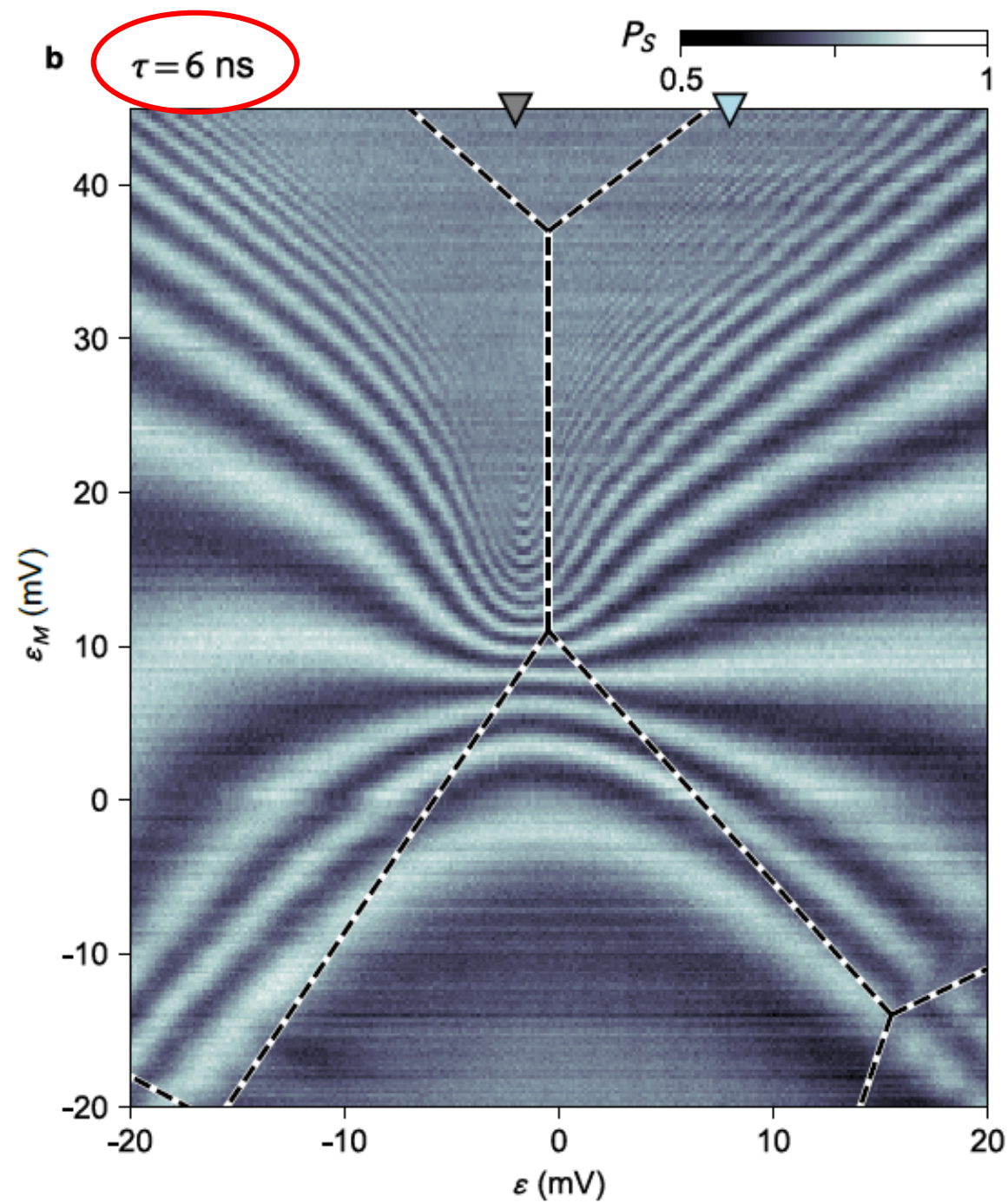




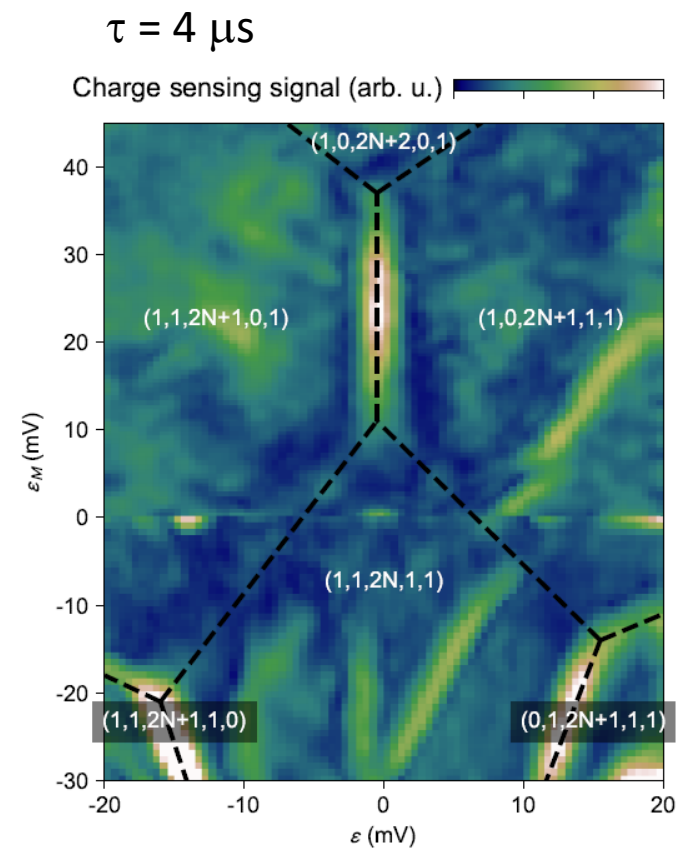
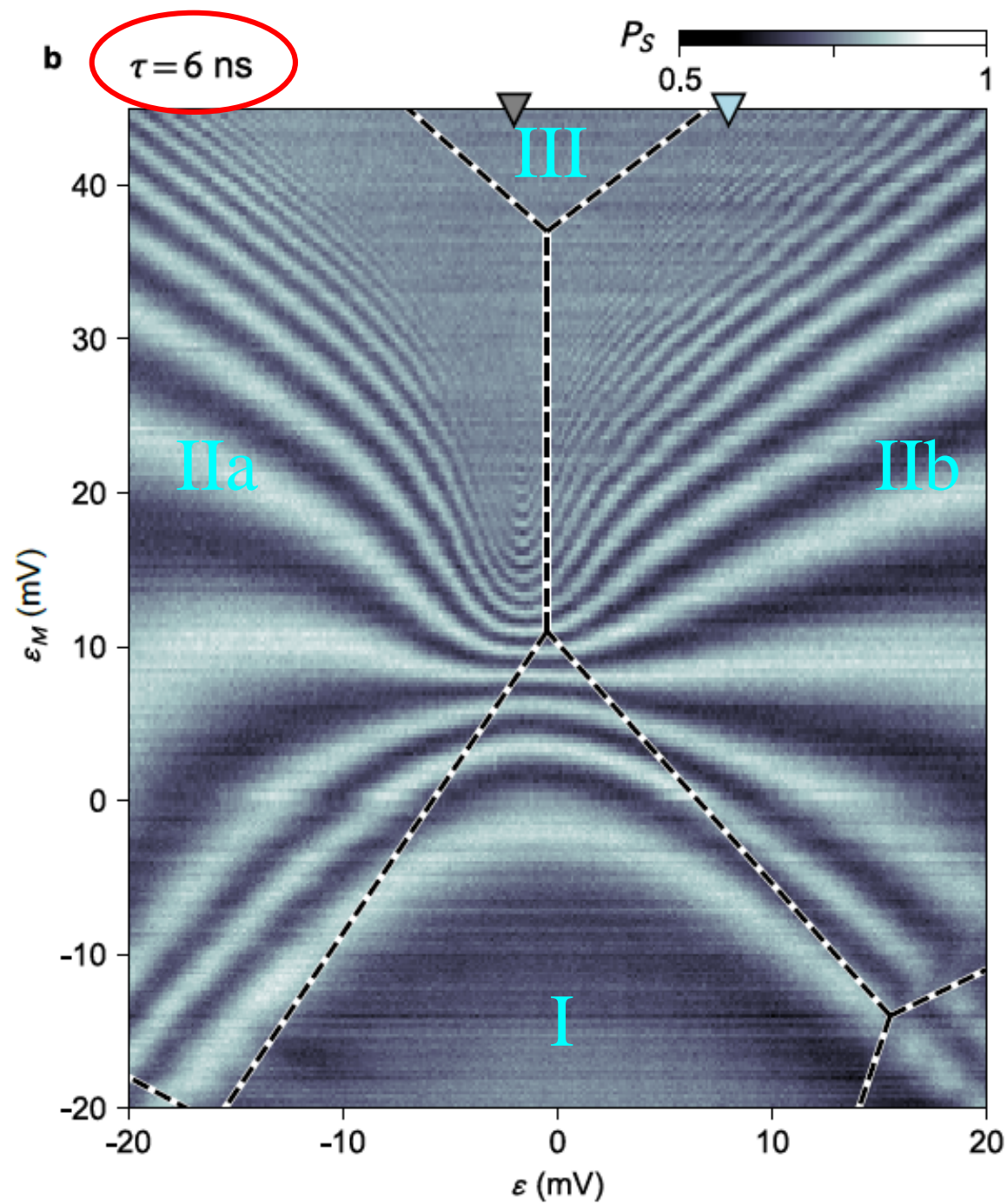


$$|S^L\rangle |S^R\rangle$$

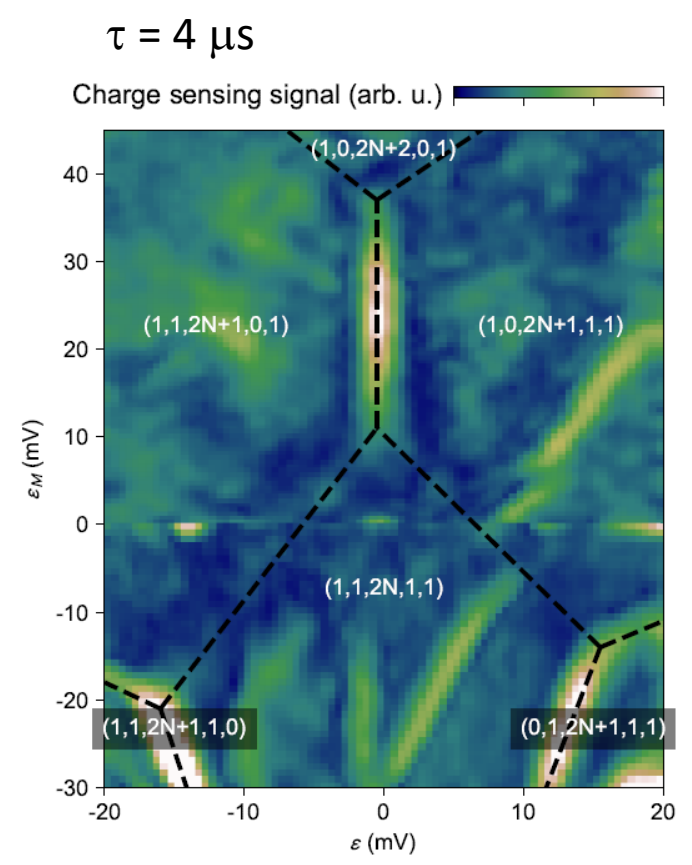
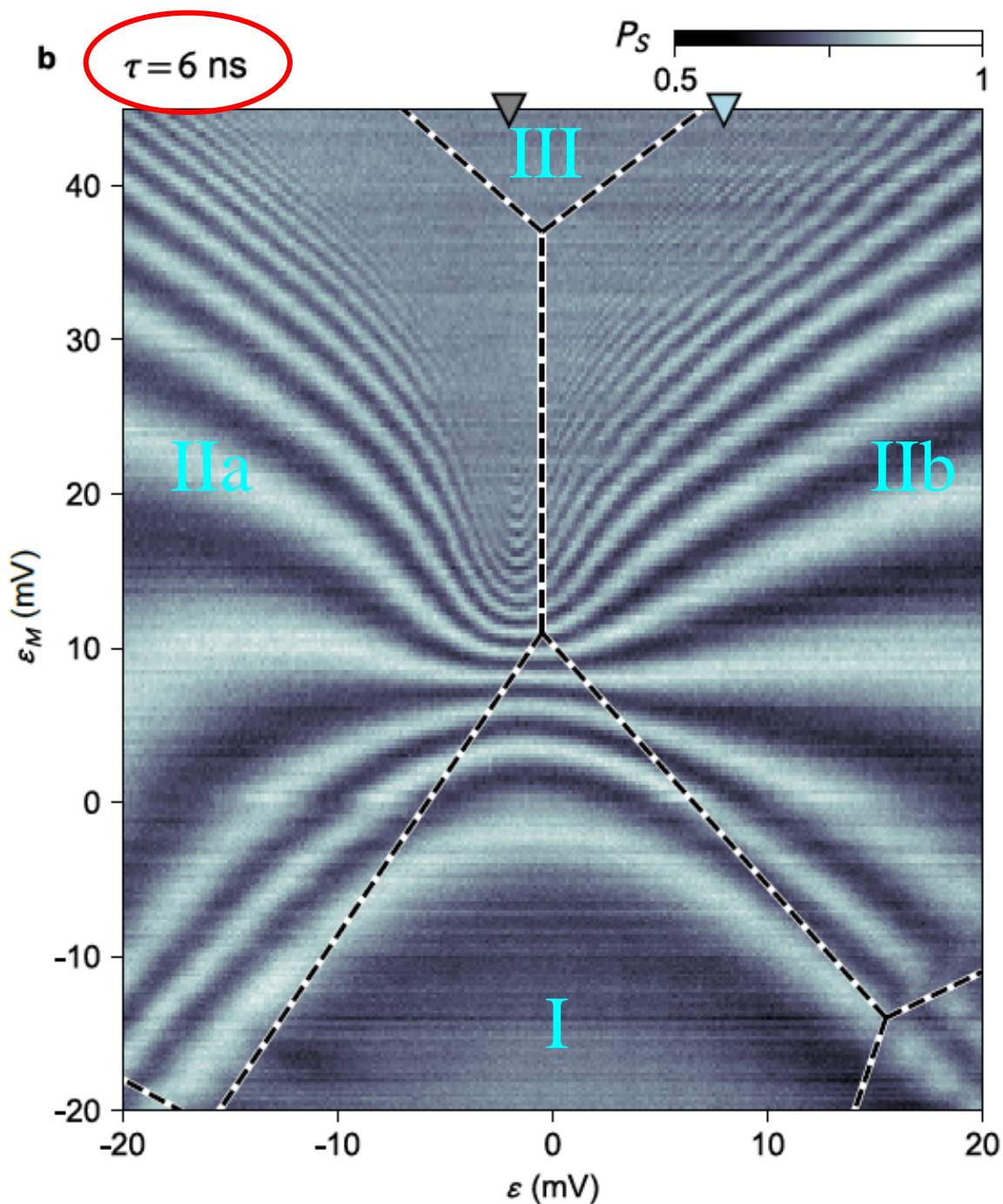
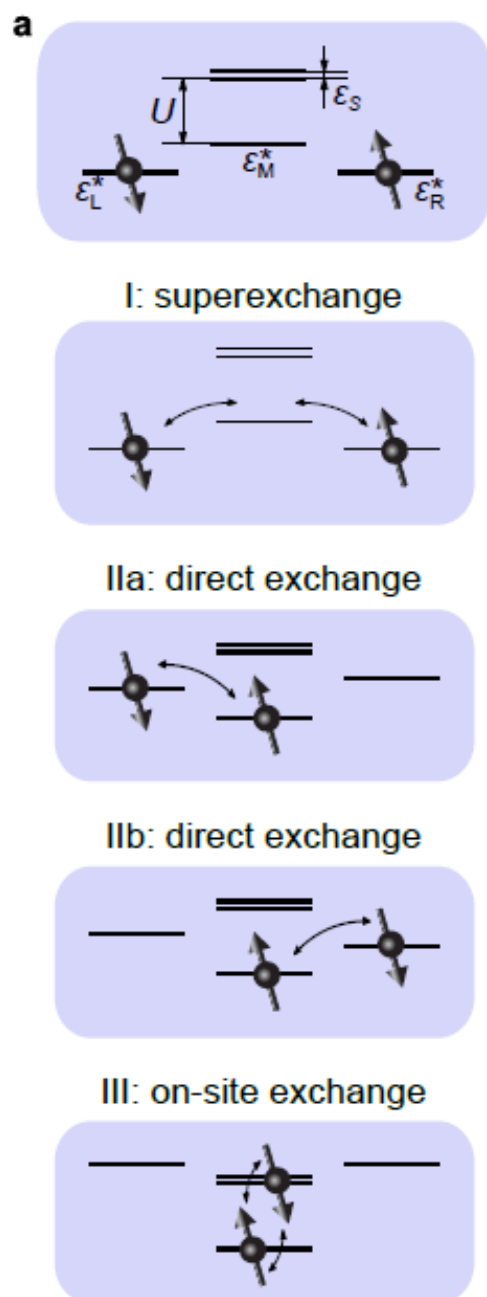
$$\frac{1}{2} (|S^L\rangle |S^R\rangle - |T_0^L\rangle |T_0^R\rangle + |T_+^L\rangle |T_-^R\rangle + |T_-^L\rangle |T_+^R\rangle)$$



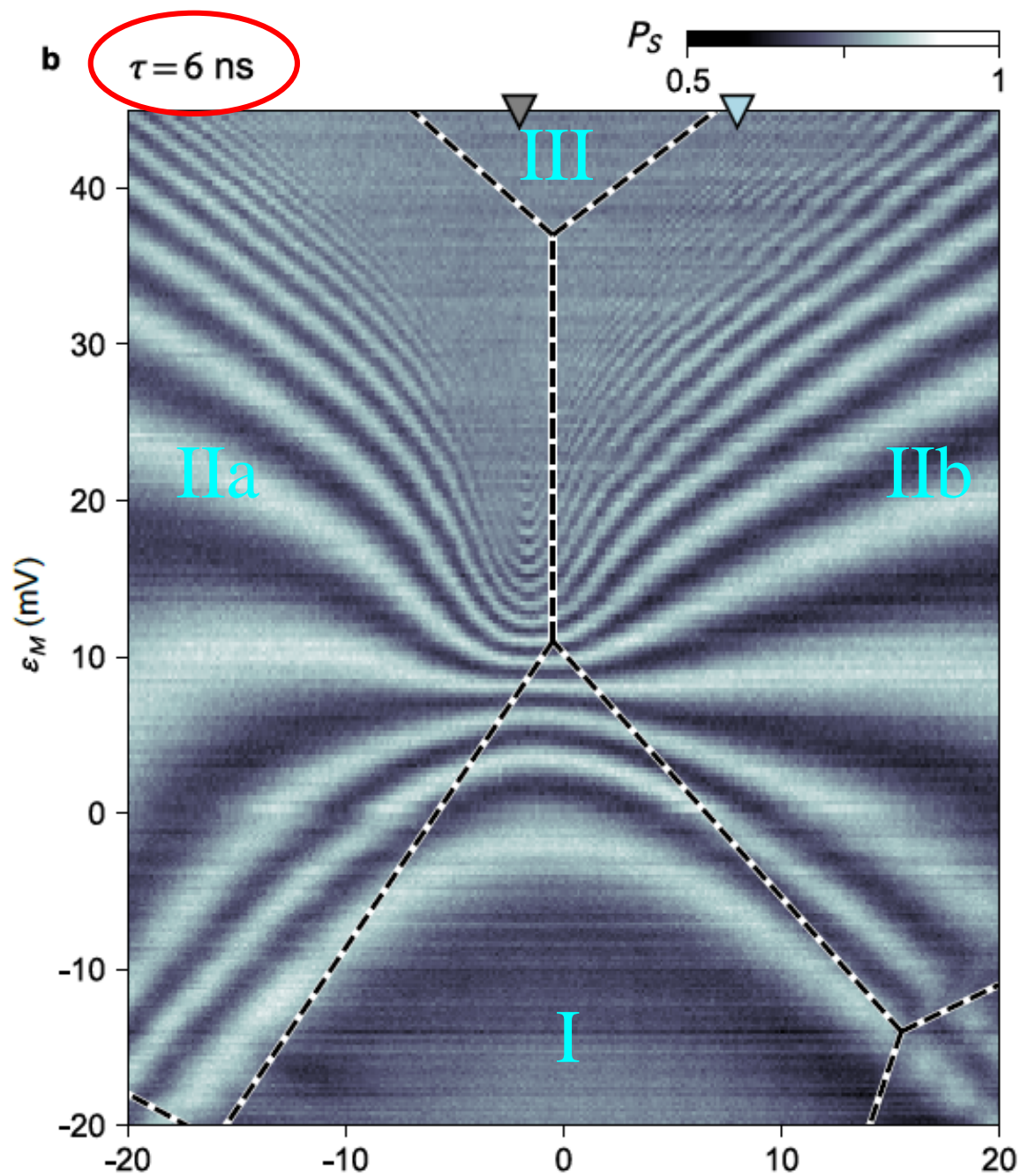
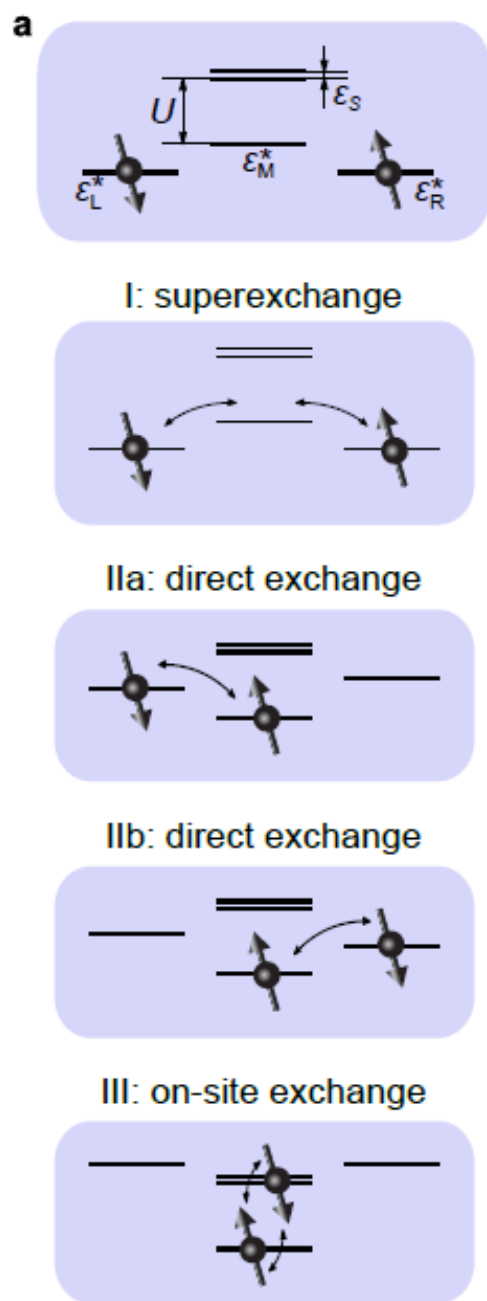
$$\varepsilon = (V_{L2} - V_{R1})/\sqrt{2} + C$$



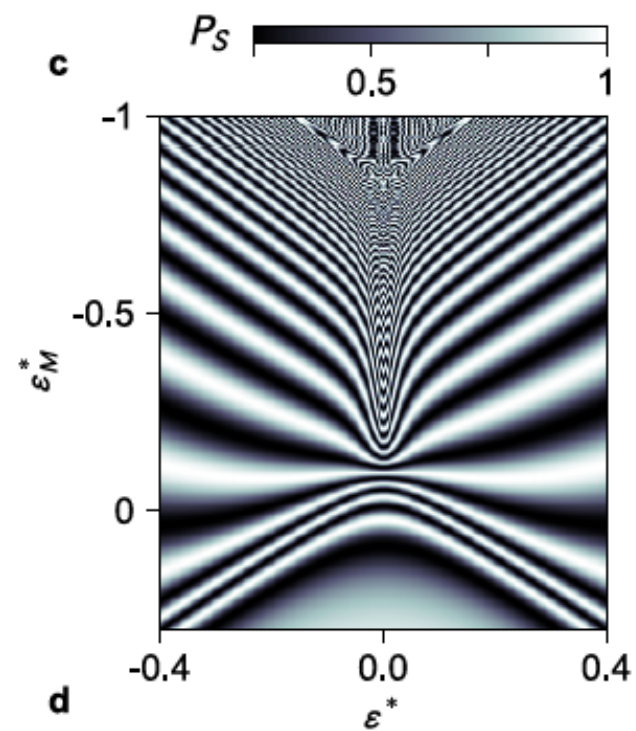
$$\varepsilon = (V_{L2} - V_{R1})/\sqrt{2} + C$$



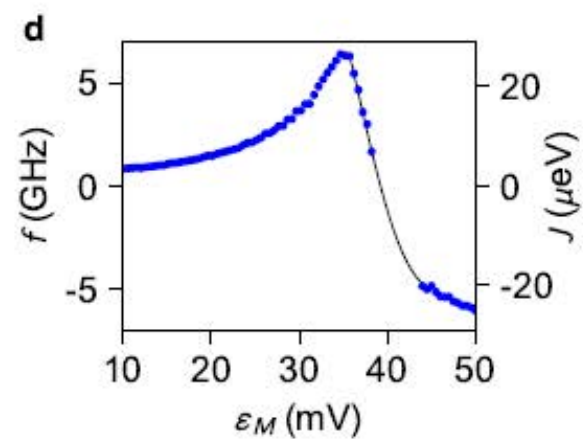
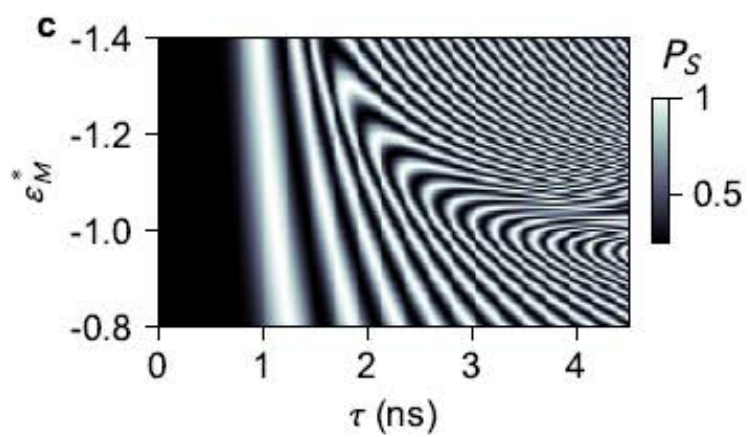
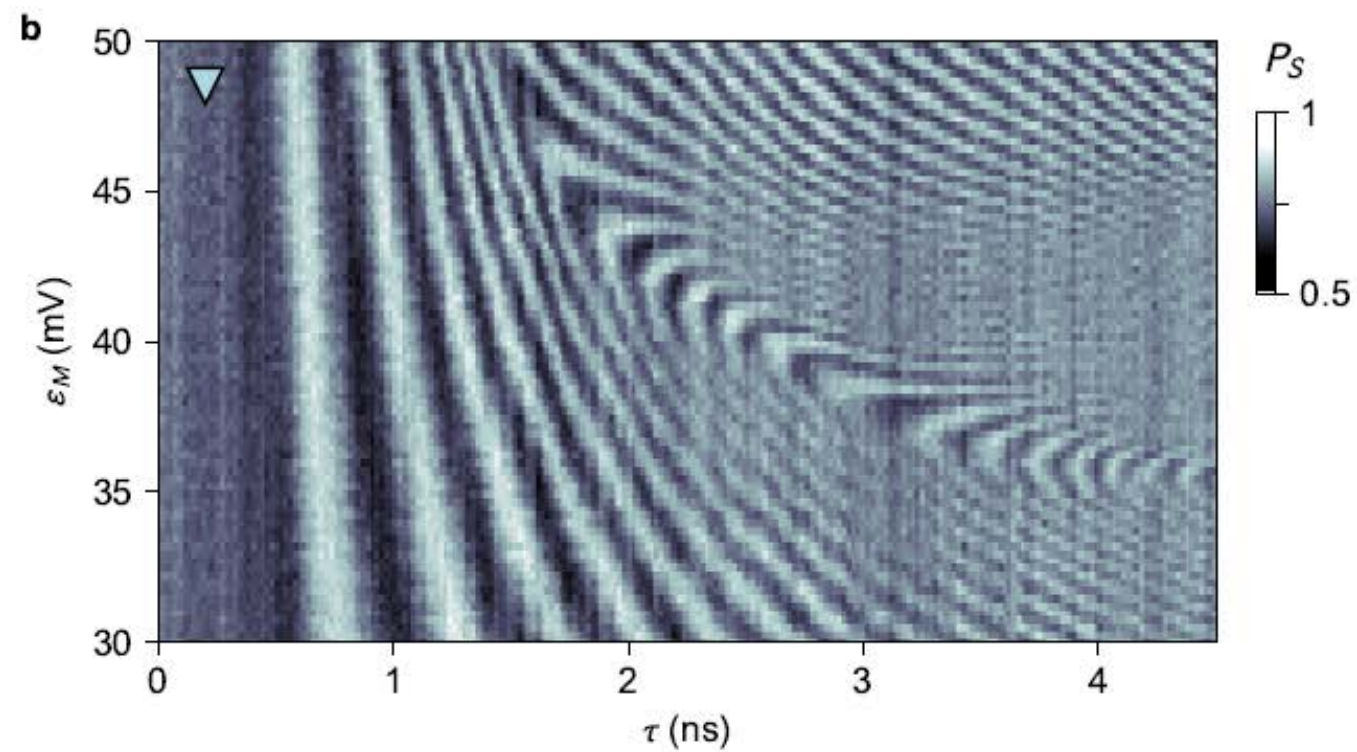
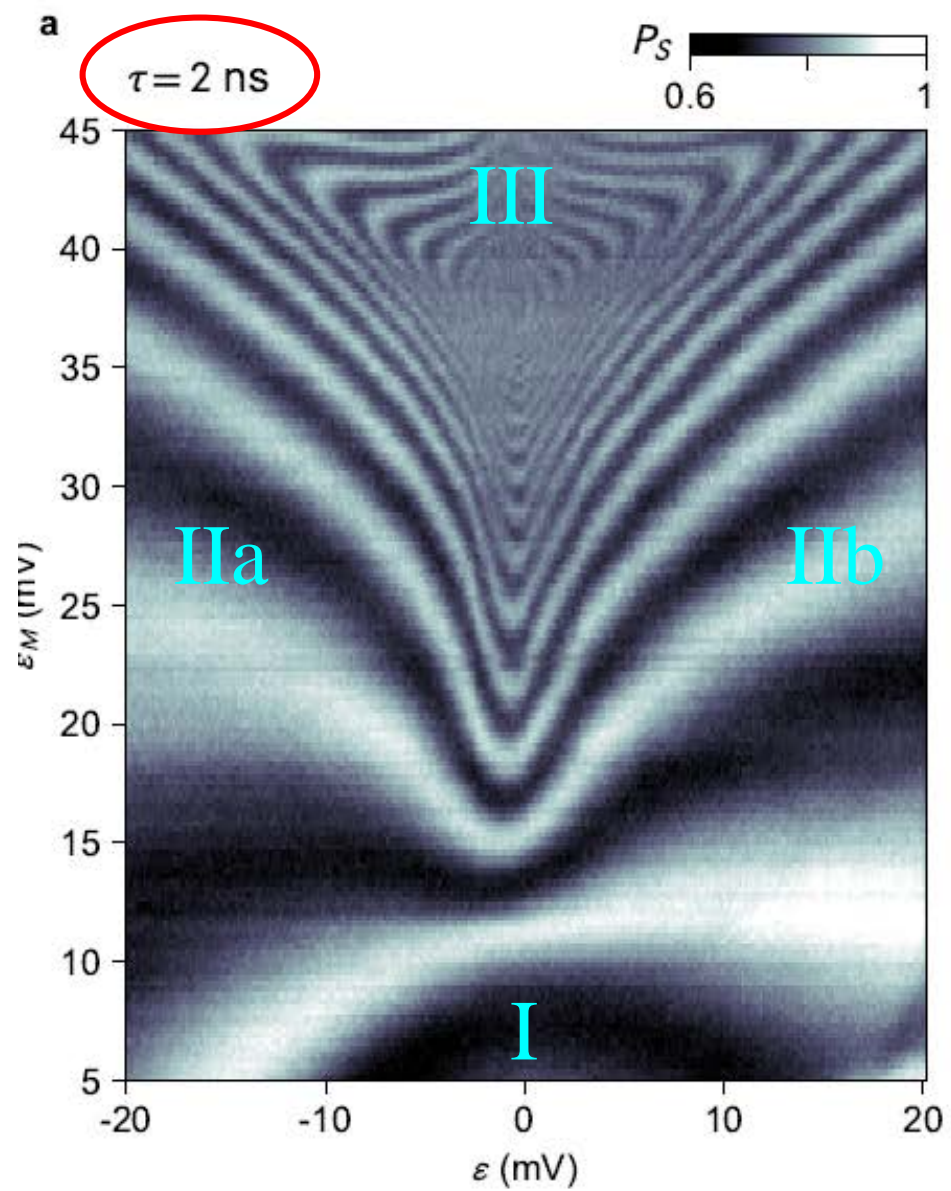
$$\epsilon = (V_{L2} - V_{R1})/\sqrt{2} + C$$



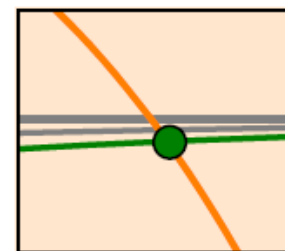
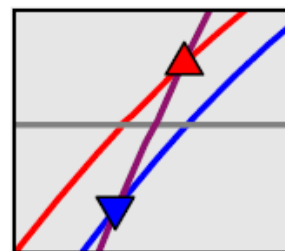
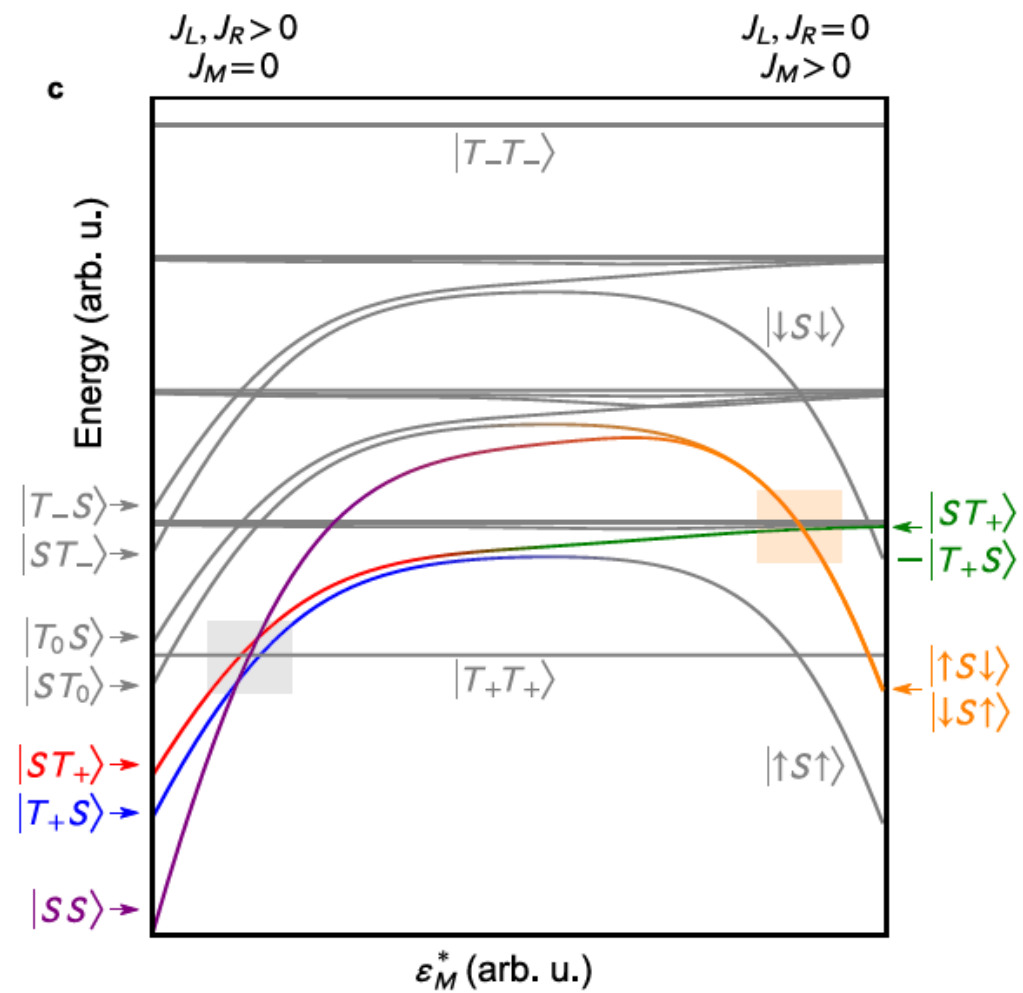
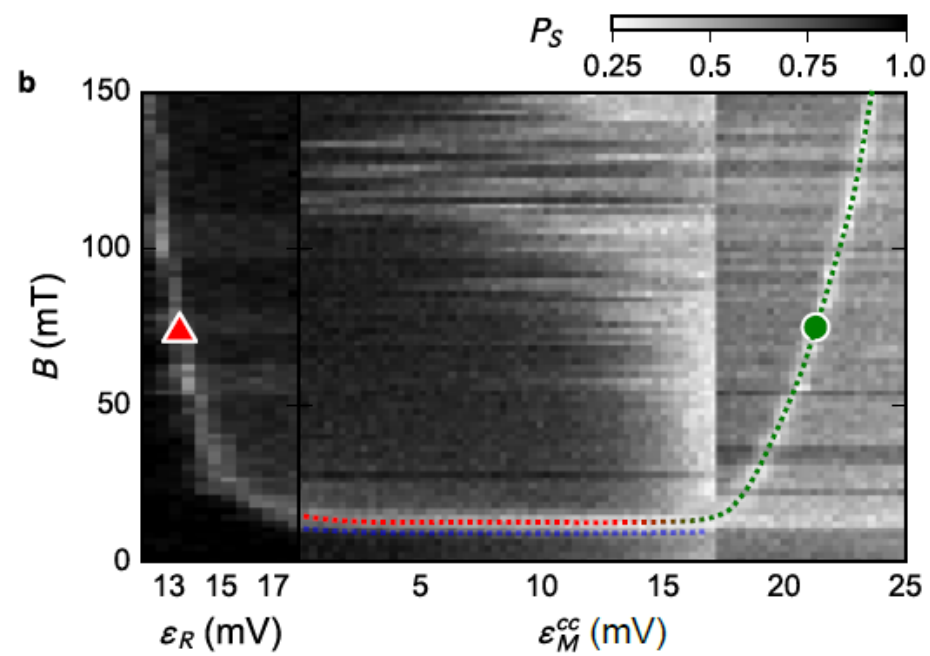
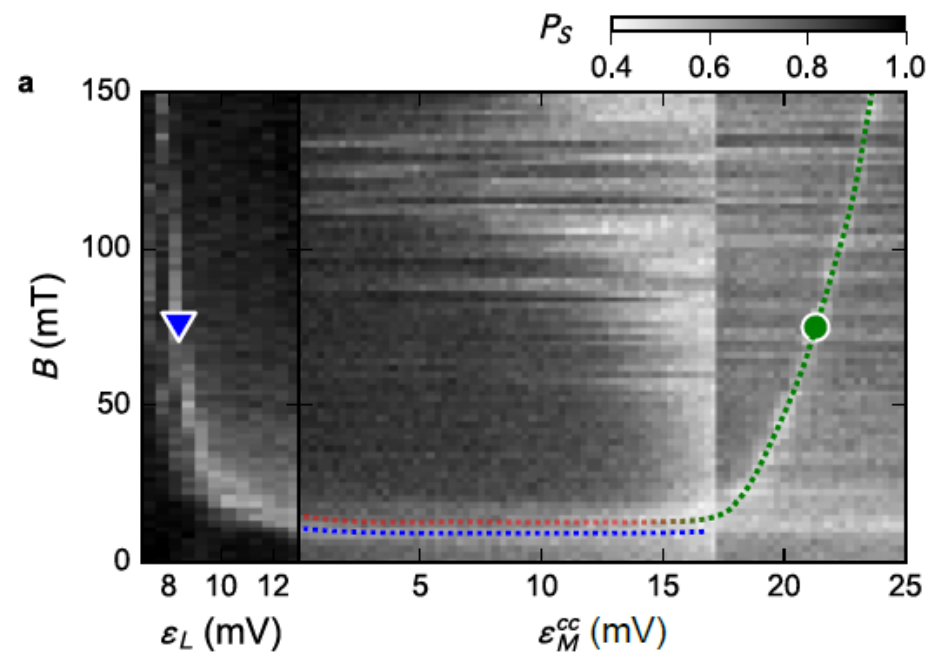
$$\epsilon \text{ (mV)} \quad \epsilon = (V_{L2} - V_{R1})/\sqrt{2} + C$$

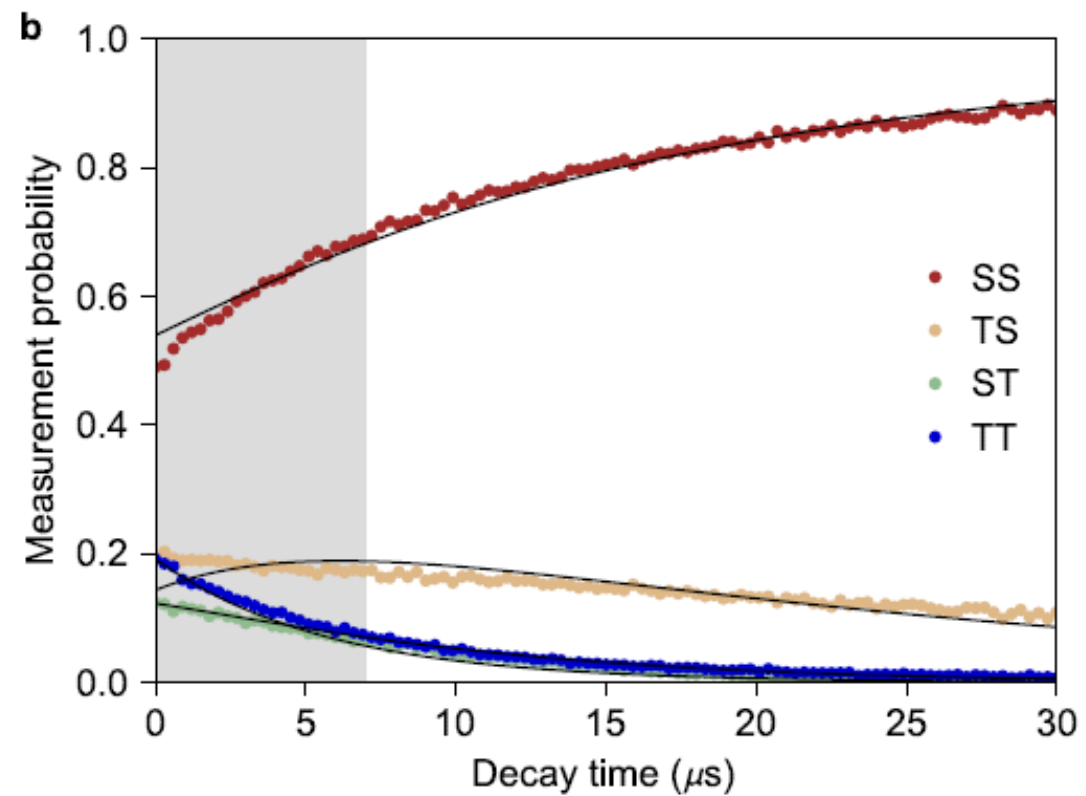
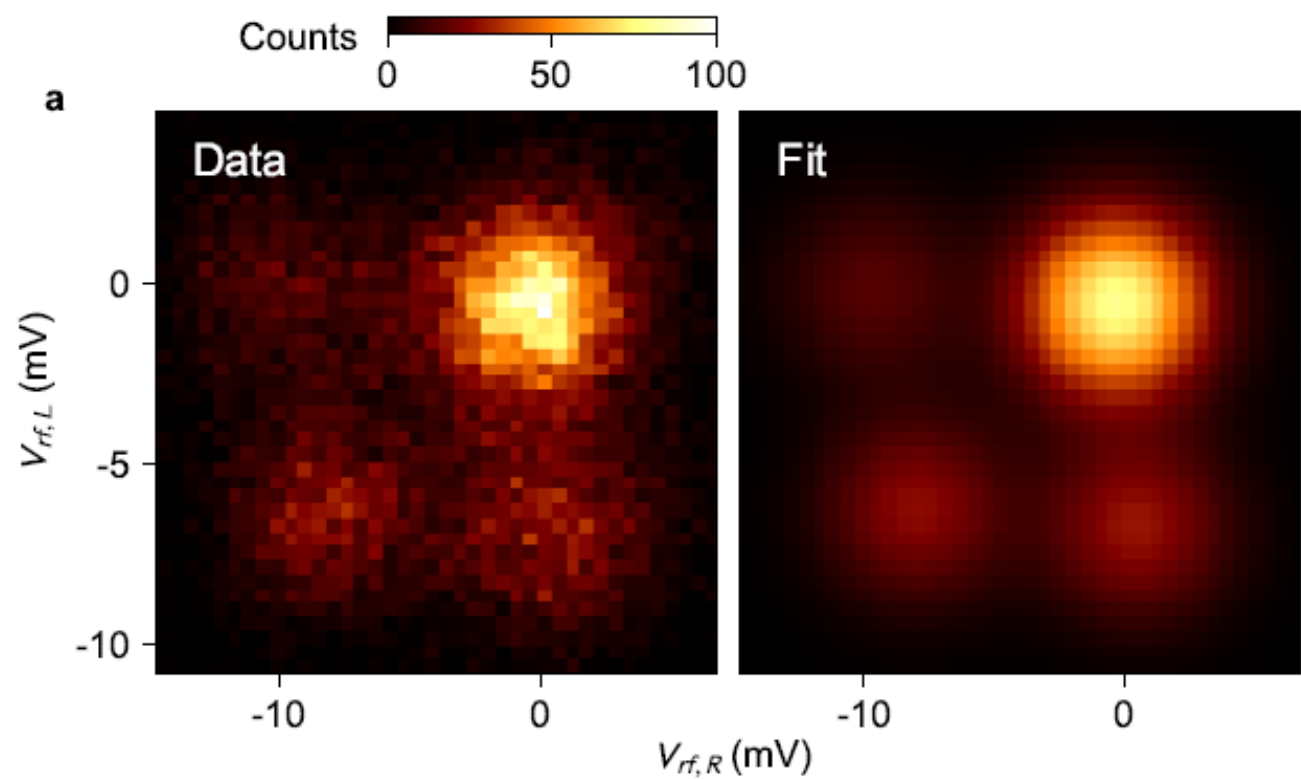


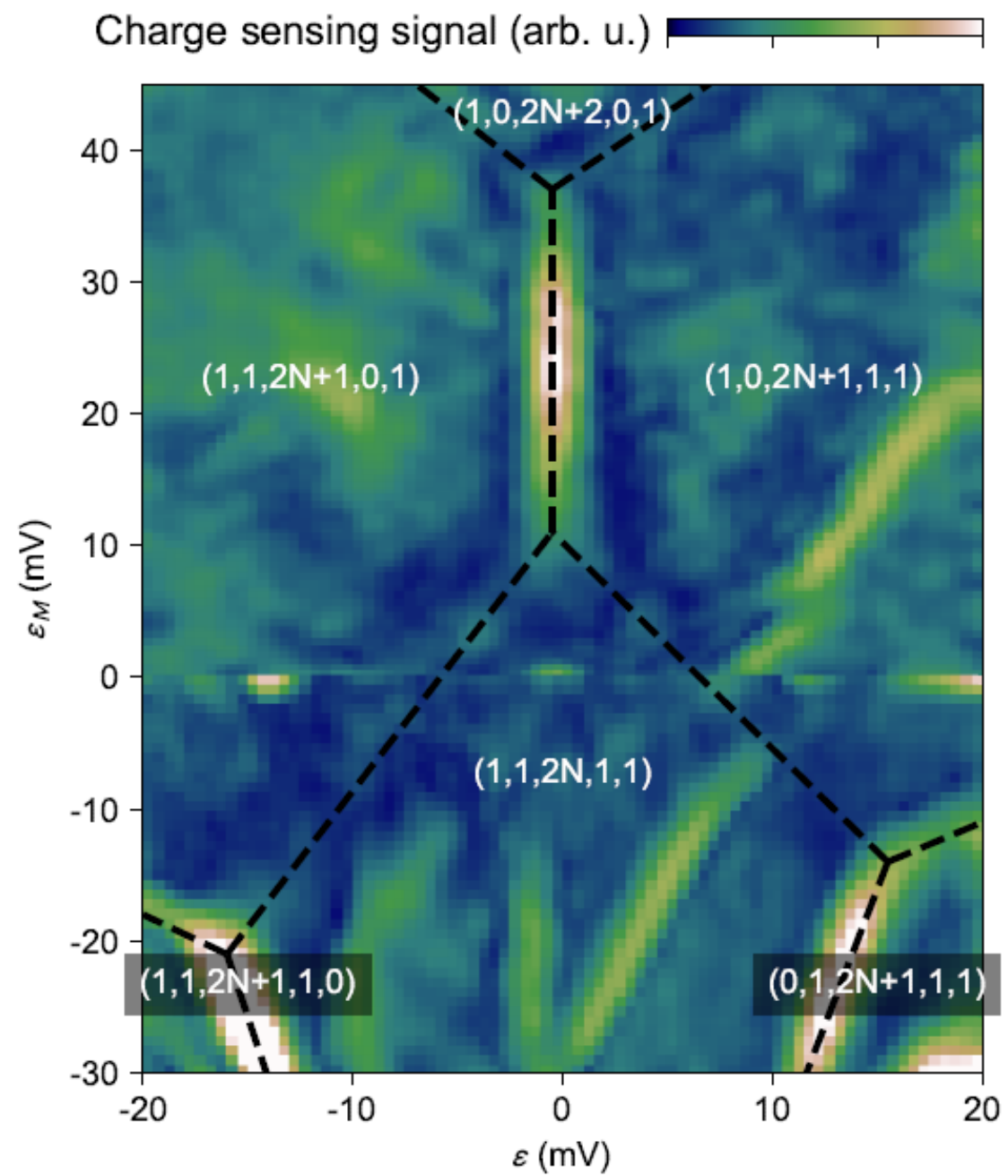
Hubbard model
simulation



Supplementary







$$\hat{H} = \sum_i \left(\varepsilon_i^* \hat{n}_i + \frac{U_i}{2} \hat{n}_i (\hat{n}_i - 1) \right) + \sum_{i \neq j} \frac{K_{ij}}{2} \hat{n}_i \hat{n}_j +$$

$$- \frac{\xi}{2} \hat{S}^2 - \sum_{\langle i,j \rangle} \sum_{\alpha} t_{ij} (c_{i,\alpha}^\dagger c_{j,\alpha} + \text{H.c.}), \quad (\text{S5})$$

