

**Quantum dots**

- (a) (i) How can individual electrons be trapped in semiconductor quantum dots?  
*ans*
- (ii) What are some common material platforms?  
*ans*
- (b) (i) What does the charge stability diagram of a double quantum dot look like?  
*ans.*
- (ii) What physical effects do we see?  
*ans.*
- (iii) How can we measure a charge stability diagram?  
*ans.*
- (c) Explain how the state of a single electron spin in a quantum dot can be read out. What experimental conditions need to be met for the read-out to achieve high fidelity?
- (d) Explain two methods for the coherent control of a single electron spin in a quantum dot. Discuss the advantages and disadvantages of both. Bonus: explain a third method.
- (e) Explain two types of two-qubit gates between single-electron spin qubits in quantum dots. Discuss the advantages and disadvantages of both. Bonus: explain a third method.
- (f) (i) What are the limiting decoherence mechanism for single-spin qubits in quantum dots?
- (ii) How do they impact the fidelity of single-shot readout and of single- and two-qubit gates?
- (iii) How did the timescales and limiting mechanisms evolve over the years?
- (iv) To what extent can dynamical decoupling techniques extend the decoherence times?
- (v) What does this tell us about the decoherence mechanisms?

**Nitrogen vacancy qubits****Superconducting qubits****Ion trap qubits****Adiabatic quantum computing**