

# Quantum Dot qubit in bilayer graphene heterostructure

Peter Koopmann, Filip Mrcarica, Huaiyu Ge, Otto Schmidt

October 20, 2023

# Qubit definition

- Most platforms are by design limited to a certain definition of qubits. E.g. superconducting circuits encode their qubits via a charge degree of freedom.
- To make a more versatile platform it is therefore essential to be able to express a qubit in as many forms as possible.
- Here our platform, the heterostructure BLG QD qubit, has an advantage. Not only can we use the spin degree of freedom from electron or holes (yes, we can do both!), but we can also use the charge and valley degree of freedom.
- So the same design allows to experiment and simulate different types of qubits with their own idiosyncratic pros and cons.

# Qubit manipulation via SOC proximity effect

- The quality of a qubit for information processing is also determined by the ability to control and manipulate.
- On our platform, we use the SOC proximity effect of vdW layers to turn on/off interaction with external fields.
- This effect of SOC is realized via interlayers coupling in BLG and enables fast qubit operations.
- We can thereby decide which qubit to manipulate or preserve.