**Week 18**

This week I had a further look into the propagation dynamics following a local quench. Motivated by this paper looking at quenches on trapped ions: https://www.nature.com/articles/nature13461. I had a look at the concurrence between pairs of atoms in the chain following a quench at site 1. The concurrence is an entanglement monotone for a pair of qubits. I need to understand further how it is defined but it measures the entanglement of mixed qubit states which was essential in our case as the states of pairs of atoms are mixed (product of taking reduced density matrix of a pure state). Interestingly, we see very different behaviour depending on how close to the anti-blockade constraint we are. When, we are far below the constraint the pairwise entanglement forms between every other pair of atom’s analogues perhaps to how a dimer model would be set up in the system. However, when the system is right by anti-blockade, we get a quasiparticle excitation of this pairwise entanglement starting at atom 1 and two and propagating to the end where it is reflected. See pdf for details

With the report write coming thick and thin, I have started to think about what my narrative for the report is going to be. This is kinda of the idea I am going on:

Motivated by showcasing 1D Rydberg atom arrays as an entry point for studying out of equilibrium dynamics of isolated quantum many body systems; We evaluated to what extent elements of quantum informational theory can be used to study out of equilibrium behaviour onset by quenches.

\*\*Edit\*\*

After the meeting this week and upon reflecting a bit, I think it my report should be an investigation of quenches on 1D Rydberg atom arrays. The complexities that arise with non-equilibrium behaviour and entanglement are the by-products of the investigation. I feel the titling the project “Quenching 1D Rydberg Atom arrays” give a large scope to talk about a lot of interesting underlying concepts (thermalisation, scars, quasiparticles and so on..) without having to make definite conclusions on them. Takes the pressure off tying to answer some quite difficult questions and lends the report into being more of an investigation.

The structure would then follow a bit like this (still to be worked on..)

**\*\*Title: Quenching 1D Rydberg atom arrays\*\***

**\*\*1D Rydberg atom array\*\***

**\*\*Entanglement entropy\*\***

**\*\*Global Quench\*\***

**\*\*Local Quench\*\***

**\*\*Limitations and further work\*\***

**\*\*Conclusions\*\***