**Week 16**

The focus of this past week was to try piece together a lot of the different thing I have been looking at to build a narrative for the project i.e why should we care about what you are looking at. This has been quite a difficult task but rather useful as has forced me to look at what is really important. It is still however very much an on-going process.

I found it useful to almost start form a zoom out approach and ignore the individual aspect of the system. Then work my way in. This structure kinda follows as such:

* - Motivate why the out of equilibrium regime for isolated many body quantum systems is interesting.
* - Why entanglement dynamics of these system could be the key to understanding many different aspect such as transport of information through the system, information scrambling and thermalisation (does this happen?). In a way is entanglement entropy on a isolated qm system in some way analogous to entropy in a classical system. Big question.
* - Lastly what make the local quench septically interesting, why should we study it on top of the global quench.

**\*\*Motivating non-equilibrium quantum many-body physics\*\***

* - What we are looking at is a non-equilibrium system, specifically a quantum many body non equilibrium system. These systems are interesting because a lot of dynamics come in to play when we evaluate weather a quantum many body system reaches equilibrium. Correlations evolve in time and information can be scramble throughout the system. Lack of universal organising principles governing the system. Correlate their ensemble behaviour.
* - It is not obvious what feature of many body quantum mechanism makes quantum thermalization possible in a sense analogous in which dynamical chaos makes classical thermalization possible.
* - Lots of studies look towards correlations within the system
* - Greater understanding of the system out of equilibrium as the world in not perfect
* - We have the technologies now (optical tweezers) to really study the out of equilibrium regime.

**\*\*Motivating the Local quench and propagation in our system\*\***

* - Local quenches allow us to study the propagation of entanglement through the system. Since interactions are short ranged (pretty much NN), there is a finite time for entanglement and information to propagated throughout the system. Investigating this finite time and what factors effect it will give us a deep understanding of our system.
* - With global quenches we can look at the time to grow to a saturation value, but with local quench we can do this and also look at the time delay in the impulse of entanglement generate at the quench site to reach the other end of the chain.

**\*\*Why study the dynamics of entanglement in a non-equilibrium quantum many body isolated system of Rydberg atoms?\*\***

1. 1. \*\*Gives us insights to how information spreads in our system\*\* (how fast does information spread, can quantum transports protocols be creates)
2. 2. \*\*Gives us insights to what extent our system thermalises\*\* (how does quantum statical mechanics emerge? do we get strong ergodicity breaking phenomena (MBLs), weak ergodicity break phenomena (scars), where on the scale are we)

The button at the top has a pdf of notes I prepared for this week’s meeting. It. Touches on a lot of things discussed above and goes into more detail with ideas and concept which could be useful for the presentation.