

## Notes from Topical Session on Frontiers in Condensed Matter and Quantum Systems

Andrew Green presentation gave a brief overview of the topic and these aspects, which are still argued, such as emergence in equilibrium versus non-equilibrium system. Three themes have been selected to demonstrate the overlap and influences between these. A challenge faced by the field is to develop methods of categorising these systems in a way that produces natural overlaps between areas.

### 1) Quenches and sweeps

- ben doyen: 1d quantum system, start system with a discontinuity in temperature, region in middle with universal steady state behaviour, size increases in time, growing region characterized by out-of-equilibrium behavior, related to driven steady states

### 2) Driven steady states

Quantum criticality:

- Equilibrium: spatial scaling, dynamical scaling, universality
- Search for universal out-of-equilibrium behaviour, universal driven steady state behaviour: they have been able to show this in various cases, tunneling in quantum dots, ads/aft correspondence
- Quantum criticality draws connection between equilibrium and driven steady states.

### 3) Equilibrium emergence

*Question 1:* When and to what extent can out-of-equilibrium steady states be related to thermal (Gaussian) equilibrium? Is this a matter of temporal scales involved?

*Question 2:* What is the role of out-of-equilibrium "adiabatic" connectivity? Can be related to entropy driven transition, similar to stochastic resonance?

#### Methods:

- AdS/CFT
- Tensor networks
- Matrix-product-ansatz, DMRG

Instability of critical metals (?) Quantum order by disorder

Connection to classical physics.

Kamenev, stabilisation of niches by fluctuations