Stellingen

behorende bij het proefschrift
Translational Symmetry Breaking in Holographic Strange Metals

1. Spectral functions of holographic probe fermions in a lattice show some remarkable features, for example showing resemblance to the Fermi arcs that have been observed in the pseudogap phase of the cuprates. (Chapter 4)

2. Holographic systems introduce many artefacts, such that the physical origin of e.g. the Fermi arcs mentioned in proposition 1 is surely not relevant to the physical experiment. Nonetheless, careful considerations of the generalities of such systems can reveal part of the nature of strongly correlated systems. (Chapter 4)

3. The Gubser-Rocha strange metal is a prime candidate for a faithful holographic representation of the cuprate strange metal, especially when the dilaton is quantized to be a marginal operator. (Chapter 5)

4. Linear-in-temperature resistivity in the Gubser-Rocha model is ubiquitous and does not depend on the actual mechanism that dominates the electrical transport, be it diffusive or convective transport. (Chapter 6)

5. Transport phenomena in holographic strange metals in the presence of weak translational symmetry breaking can be readily understood in terms of a hydrodynamical description where first-order Umklapp effects are taken into account. This same understanding does not apply at strong lattice potentials, where the nonlinear character of the Einstein equations comes into full force. (Chapter 6)

6. In the presence of strong translational symmetry breaking, diffusional processes dominate transport in the holographic lattice. Rapid scrambling and the maximally chaotic nature of black hole horizon provide a tentative explanation for the saturating Planckian scattering rate observed in our numerics, however its relation to the real strange metal is still unclear. (Chapter 6).

7. Holographic strange metals can be a useful resabout properties belonging to the universality class of the quantum critical phases present in the real-world strange metals.

8. Numerical computations of holographic strange metals in the presence of an ionic (or other) lattice form an excellent playing ground to explore the physics of strongly coupled systems where translational symmetry is broken.

9. The current availability and ease-of-access of high-power computing to researchers calls for a more concerted numerical effort on the part of the AdS/CFT community.

Floris Balm, 16 May 2023

10. The recent attention that AdS/CFT has received in experimental undertakings is promising, since the field is ripe for a paradigm shift. As the two communities speak wildly different languages, close partnerships will need to be formed in order to effectively bridge the gap and make full use of the potential predictive power of holography. (PNAS (2018): 5392-5396.)
11. Strong measures beyond simple data retention policies will have to be taken in order to ensure efficient transfer of knowledge and maintenance of existing code bases for future generations. An example of this could be open access requirements for code to be included in funding rules.

Floris Balm, 16 May 2023