# Applications of AdS/CFT to strongly correlated matter: from numerics to experiments

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# Stellingen

behorende bij het proefschrift

*Applications of AdS/CFT to strongly correlated matter: from numerics to experiments*

1. The Gubser-Rocha holographic metal is a good candidate for a holographic strange metal whose DC transport properties are robust against regime changes in the optical spectrum. (Chapter 2)
2. The hydrodynamic excitations of a fluid with a periodic external perturbation are better understood as Bloch waves and interact through the periodic background. (Chapter 3)
3. Experimental observations of optical transport in strange metals show similarities to the behavior of a hydrodynamical charged fluid in a periodic background. (Chapters 2 and 3)
4. The Gubser-Rocha family of solutions is a line of marginally deformed theories within the landscape of holographic Einstein-Maxwell-Dilaton solutions. (Chapter 4)
5. An $AdS_4$-to-$AdS_4$ domain wall, obtained from backreacting a system of fermions in $AdS_4$ and in the presence of a soft wall, provides a good model for a holographic single Fermi surface system with infinitely long-lived excitations. (Chapter 5)
6. The canonical Fubini-Study metric on the space of coherent states in a $CFT_{d+1}$ can be understood as a geometric distance in the phase space of timelike geodesics in $AdS_{d+2}$. (Chapter 6)
7. It is understood that the energy sector of some strongly correlated systems is universal and dominated by chaos. The diversity of strange metallic compounds hints at a similar universal phenomenon behind the transport of charge.
8. The landscape of interesting holographic models has remained largely unexplored due to computational difficulties.
9. While exact dualities in AdS/CFT emerge from string theory, the holographic principle at its core is a more fundamental equivalence between gravitational systems and lower-dimensional quantum systems.
10. The recent advances in explaining the physics of strange metals using disorder in the SYK model [Science 381, 790-793 (2023)] and connecting the SYK model to holographic $AdS_2$ fixed points [npj Quantum Materials 7, 56 (2022)] give credence to the idea that holographic systems are good toy models to understand the strange metals.
11. The scientific method is one of the greatest achievements of mankind to date and should remain a fundamental pillar of our society in this information age.

Nicolas Chagnet, 11 juni 2024