Kurzfassung

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- **Titel der Dissertation:** Semiholographic Thermalization in Strongly Coupled Nonabelian Gauge Theories

Semiholography is a theoretical framework, set up to provide a consistent effective description of the physical systems involving both weakly coupled and strongly coupled degrees of freedom, where the latter are modelled by gauge/gravity duality, also known as holography. In this thesis, we explore this framework in the context of strongly coupled plasmas in non-equilibrium settings, motivated in particular by the non-equilibrium evolution of the Quark Gluon Plasma. In the context of QGP, the model couples a weakly-coupled sector, describing hard partons, with a strongly-coupled soft holographic sector, representing the soft bath of gluons radiated by the hard partons, via gauge-invariant operators. Following a brief theoretical introduction, I will describe the semiholographic approach in general and using illustrative examples, focussing in particular on the phenomenological construction. A key element is that the semiholographic construction has a locally conserved total energy-momentum tensor.

After the general introduction, I discuss a hybrid two-fluid model coupled via their effective metrics. This coupling is dictated by the respective energy-momentum tensors. I explore the consequences of such a coupling in and near thermal equilibrium by investigating the rich phase structure and the collective modes.

Following this discussion, I will describe a semiholographic toy model for QGP thermalization in $2 + 1$ dimensions. This involves a classical Yang-Mills sector, describing the overoccupied gluon modes at the saturation scale, coupled to a strongly interacting holographic sector, representing the soft degrees of freedom. The toy model represents a proof of principle calculation, demonstrating for the first time the transfer of energy from the Yang-Mills sector at the boundary to a growing black hole in bulk anti-de Sitter space including backreaction.

Finally, I will discuss a semiholographic model of trapped impurities in $0 + 1$-dimensions. Along the way, we will develop an algorithm to solve
Jackiw-Teitelboim gravity coupled to non-conformal matter. The holographic sector, represented by an infrared anti-de Sitter spacetime with non-conformal matter, \( N\text{AdS}_2 \), represents a confining potential for the trapped impurities. The impurities serve as a self-consistent boundary source for the holographic sector.