We have generalized the formalism and derived explicit general expressions for the optical f-sum rule. We have constructed the first regular lattice with finite (semi-elliptic) band edges in $d = \infty$ and have thus obtained the first DMFT results for coherent and isotropic transport compatible with a semi-elliptic density of states.

We have reported on progress in the realistic modeling of strongly correlated electron systems using the hybrid LDA+DMFT method. This recently developed method starts with the ab initio density functional theory and treats the missing correlations within DMFT. Evaluating the resulting multi-band problem using QMC, we have computed photoemission and x-ray absorption spectra for the transition metal oxide $La_{1\text{-}x}Sr_xTiO_3$. The results represent a significant improvement over conventional LDA calculations. We have discussed the impact of the QMC discretization error and computed a first estimate of the t_{2g} contribution to the optical conductivity.

The unifying project of this thesis has been the modeling of strongly correlated electron systems in the vicinity of a metal-insulator transition by application of the dynamical mean-field theory which becomes exact in the limit of infinite dimensionality. Within this project, we have studied single-band as well as multi-band models, pursued both pure model Hamiltonian approaches and the ab initio LDA+DMFT approach and computed both local and transport properties. A large amount of numerical work, i.e., the planning, organization, and analysis of several thousand QMC simulations using tens of thousands of hours of supercomputer time was clearly essential for obtaining the accurate results which we have presented in this thesis. Furthermore, we have written a large number of computer programs and have modified and extended some others. Many of our results, however, could not have been obtained without the development or improvement of methods and formalisms as well as analytical calculations. It is this more theoretical than numerical aspect of our work which we found particularly rewarding.