out for the hypercubic (hc) lattice and had been applied for general filling based on NCA (Pruschke et al., 1993) and QMC (Jarrell, Freericks, and Pruschke, 1995) calculations. Rozenberg et al. (1995) had even applied the same formalism to the Bethe lattice case (on the basis of ED and IPT data) and extensively discussed the f-sum rule in this context. Indeed, our implementation of the algorithm was soon accomplished; using an early version of our set of programs, results were published for a manganite model (Held and Vollhardt, 2000). However, we realized that the conventional treatment and the resulting f-sum rule were specific to the hypercubic lattice and not directly applicable to the Bethe lattice. In particular, we found numerical violations of the (incorrect) sum rule stated by Rozenberg. In addition, Janiš (1999) claimed the foundation of the DMFT treatment of conductivities to be incorrect.[53] Thus, we found it necessary to thoroughly check the formalism and to derive extensions for the general case in high dimensions.

We have carefully reviewed the Kubo formalism for the optical conductivity and the simplifications in the limit of infinite dimensionality (or, more generally, infinite coordination number). We have presented the first evaluation of the theory in the case of $t-t'$ hopping and have shown that Merino and McKenzie's (2000) (unjustified) use of the conventional hc formalism leads to significant errors in the computation of the transverse conductivity and the thermal conductivity. We have derived a new expression of the optical f-sum rule which is universally valid within the DMFT and additionally a form specific to the general dispersion formalism developed in Sec. 2.3.

We have presented a comprehensive discussion of the optical conductivity for lattices with semi-elliptic "Bethe" DOS in infinite dimensions. In particular, we have discovered a flaw in Freericks's (2000) derivation of $\sigma(\omega)$ for a tree-like layout of the Bethe lattice and have shown that the assumption under which Millis (2002) obtained essentially the same result is equally unfounded. We have pointed out that an application of the hc formalism generally implies anisotropic transport and have established the connection between the f-sum and a static local property of such models. We have further demonstrated and explained the incoherence of transport resulting from Stumpf's (1999) single-chain layout of the Bethe lattice or from strong offdiagonal disorder and have developed a necessary criterion for coherent transport in the noninteracting limit. We have also presented the first consistent derivation for $\sigma(\omega)$ compatible with a semi-elliptic DOS that implies isotropic transport which is fully coherent in the noninteracting limit. This redefinition of the Bethe lattice (in the DMFT sense) as an isotropic, regular and clean lattice by the general dispersion method and the demonstration that the associated transport properties are robust (with respect to finite dimensionality or hopping range) removes, finally, the pathologies previously associated with the DMFT treatment of transport in connection with non-Gaussian DOSs.

We have written programs for the DMFT computation of conductivities (on the basis of local spectra) for arbitrary lattice types and have developed a scheme that

[53] It has become clear later that Janiš's (1999) statement "*the current-current correlation function and consequently the electrical conductivity do have nontrivial vertex corrections in the mean-field limit contrary to what has been up to now assumed from symmetry considerations within the conserving scheme*" does not apply to the optical conductivity (i.e., in the long-wavelength limit).