The Green–Kubo formula for electronic transport in infinite volume aperiodic solids

J. Bellissard

School of Mathematics
Georgia Institute of Technology &
Institut Universitaire de France
Georgia Tech
Atlanta, GA 30332-0160, USA

Abstract

The quantum evolution of an electron gas with or without interactions in an aperiodic solid can be described through the quasilocal algebra built over the *Noncommutative Brillouin Zone*. In the *Markovian approximation*, this evolution is generated by a dissipative Lindblad-like operator. A list of examples of such operators commonly used in quantum physics will be given. A list of axioms for such an operator leading to a unique equilibrium at finite volume will be described. The infinite volume limit will be shown to exist under additional conditions. External generalized forces, such as electric field, temperature gradient, will be introduced within the framework of the *Local Equilibrium Approximation*, leading to a justification of the linear response theory. The formal derivation of the Green-Kubo formula will be given. Then sufficient conditions will be given to insure that this formula gives a finite result.