JORY GRIFFIN, Queen's University

Quantum Transport in a Low-Density Periodic Potential: Homogenisation via Homogeneous Flows

The quantum Lorentz gas is a model of conductivity, in which one considers the evolution of some initial wave packet in the presence of a potential consisting of smooth, compactly supported 'scatterers' placed on some infinite, discrete set $\mathcal{P} \subset \mathbb{R}^d$. A result of Eng and Erdős tells us that if $\mathcal{P}$ is suitably random, the solution of the corresponding Shrödinger equation converges in some sense, in the low scatterer density limit, to a solution of the linear Boltzmann equation. This complements the famous work of Boldrighini, Bunimovich and Sinai, who proved an analogous result for the classical Lorentz gas 20 years earlier. We consider the case $\mathcal{P} = \mathbb{Z}^d$, and show that up to second-order in the Duhamel expansion the solution agrees with that of the linear Boltzmann equation, yet conjecture that at higher-orders non-Boltzmann contributions arise. Convergence of the second order term forms the bulk of our work, and requires results concerning equidistribution of pieces of horocycles in some homogeneous space. Joint work with Jens Marklof (University of Bristol).