# Single-particle approach to mesoscopic transport

Shmuel Gurvitz

*Weizmann Institute, Rehovot 76100, Israel*

We develop a new approach to transport in mesoscopic systems by using single-particle basis. Although this basis generates redundant many-particle amplitudes, it greatly simplifies the treatment. Applying our method to transport of non-interacting particles we generalize the Landauer-type formula to transient currents and to time-dependent potentials. We demonstrate that our approach can be extended for interacting case. As an example, we applied it for study a qubit interacting with a single-electron transistor (representing a measurement device). We investigated the qubit's decoherence (decay-rate of Rabi oscillations) as a function of the bias voltage. Using our method we also obtained the particle-resolve master equations, valid for any bias voltage and temperature. These equations can be very useful for many applications, in particular for counting-statistic analysis.