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An Analytical Approach to Thermal and Electrical Transport in a Mesoscopic Conductor

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Abstract: In order to consider the thermal and electrical coherent transport in a mesoscopic conductor under the influence of electron-electron interaction, in this paper, we establish a method in terms of which one can analytically obtain the Hartree self-consistent potential instead of computing it by the numerical iterative procedure as usual, which is convenient for us to describe the thermal and electric current flow through a mesoscopic conductor. If we study the electron-electron interaction at the Hartree approximation level, the Hartree potential satisfies the Poisson equation and Schrödinger equation, so when we expand the action function S(x) by Planck constant ħ, the self-consistent potential and the wavefunction can be solved analytically order by order, and the thermal and electrical conductance can thus be obtained readily. However, we just show the quantum corrections up to the second order.

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Key words: mesoscopic conductor, thermal and electrical transport

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