Local scattering theory and scattering matrices for quantum chains

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The Hamiltonian for carriers (electrons, holes) in a quantum chains constructed from quantum dots and attached straight quantum wires is usually modeled by one-particle Schrödinger operators (Laplace operator + some potentials) or Dirac operators on intricate domains of the three- or two-dimensional space. In fact, scattering processes in real chains are observed only on a rather narrow spectral interval Λ of essential spectrum centered at the Fermi-level. Therefore more simple Hamiltonians in the form of ordinary differrential operators on graphs may exhibit just the same scattering picture on Λ, as the original Hamiltonian of the chain. A key issue for engineering of such a fitting solvable models can be a local scattering theory for a finite spectral interval Λ, especially the local scattering theory for self-adjoint extensions of the same densely defined symmetric operators.

In the talk reported on we review this version of local scattering theory complemented with some new results ("chain rules" for local wave and scattering operators) and develop on this base a perturbation procedure permitting to improve results obtained as a first order approximation in the framework of described above solvable ODO model for real quantum chains with PDO Hamiltonians.

The talk is based on joint works with B. Pavlov.