Localization effects in quantum dot networks: A unified approach

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We study quantum transport in a network of chaotic quantum dots. We propose a nonperturbative formalism that has the potential to unify the three most common approaches to quantum transport: random matrix theory, the nonlinear sigma model and the trajectory based semiclassical approach. Our formalism builds on the construction of appropriate representations for a generating function that contains detailed information on charge transfer processes. Some of the representations are well suited for numerical simulations, while others are best used in analytical calculations. We shall discuss two types of localization effects: weak and strong localization. We found that changes in the dot-dot coupling and in the topology of the network can have significant effects on transport properties. The quantum chain quantum wire crossover will be described in detail.