Photon Blockade in Electron Transport through a Time-periodic Scatterer

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We investigate the electron transport through a time-periodic scatterer within the Floquet scattering theory. Transmission probability is numerically calculated in terms of the Floquet scattering matrix. We examine the transmission probability as a function of system parameters - potential height and width, incident energy, amplitude and frequency. We find two types of novel asymmetric peaks in transmission probability. One is so called "Fano" resonance which is caused by the interplay between the transport and localized states. In contrast to the Fano resonance which appears only in quantum well structures, there exists a quite general and novel phenomenon which we call here 'photon blockade'. (See the figure.) The photon blockade appears whenever the incident particle energy matches with the energy of a photon. We attribute this feature to the fact that the single photon emission process blocks a low energy-electron transport channel whenever the photon energy exceeds the kinetic energy of the incident particle.

keywords : mesoscopic electron transport, Floquet theory, photon blockade

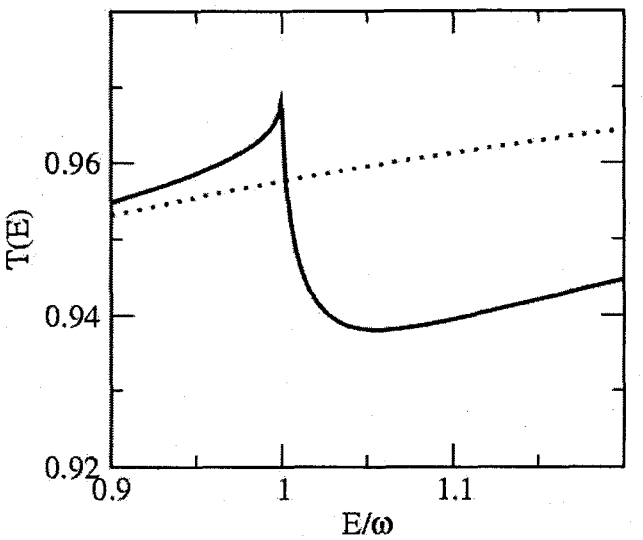

Fig.1 The transmission probability of a barrier as a function of incident particle energy E with an additional time-periodic potential of frequency ω (solid line). The dotted line denotes the transmission probability for a static barrier.