Visualization of wave function of quantum dot at Fermi-edge singularity regime.

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Self-assembled quantum dots (QDs) have been thoroughly investigated in the recent fifteen years, using electronic and optoelectronic methods. A special technique, which probes the wave function in k space, makes use of magnetotunneling spectroscopy [1, 2]. However, in an experimental situation [3] a direct correspondence between the measured values of current or capacitance, and the probability density plots is not observed and their theoretical interdependence should be corrected by a number of factors. For example, when an electron tunnels from the emitter into the QD, it can be scattered on another electron in emitter. This effect has a many - body nature and its magnitude increases with decreasing temperature. The enhancement originates from the phenomena of Fermi Edge Singularity (FES) effect [3, 4].

We consider electron tunneling spectroscopy through an InAs quantum dot in a magnetic field applied perpendicular to the tunneling direction. We examine in details the anisotropic behavior of the amplitude and shape of the resonant peaks of *I-V* curves and concluded that (i) magnetotunneling spectroscopy at FES regime allows establishing position of resonant level in QD with high accuracy. (ii) The distinguishable shape of FES peak allows extracting the amplitude with much better accuracy. (iii) FES exponent dependence on magnetic field gives additional information about potential distribution outside QD.

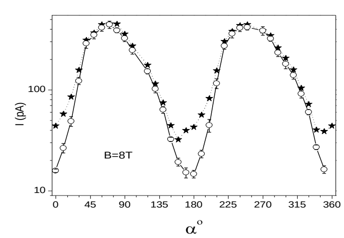

FIG. 1 Angular dependence of the peak current for B = 8 T in log scale at T = 0.4 K. Black stars are the maxima of the experimental current. White circles show the amplitude of resonant peak without back-ground current.

References

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