QUANTUM CONFINED STARK EFFECT IN WIDE PARABOLIC QUANTUM WELLS

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We show how to compute the optical functions of Wide Parabolic Quantum Wells (WPQWs) exposed to uniform electric **F** applied in the growth direction, in the excitonic energy region. The effect of the coherence between the electron-hole pair and the electromagnetic field of the propagating wave is included. The electron-hole screened Coulomb potential is adopted, and the valence band structure is taken into account in the cylindrical approximation. The role of the interaction potential and of the applied electric field, which mix the energy states according to different quantum numbers and create symmetry forbidden transitions, is stressed. As in Ref. [1] we use the Real Density Matrix Approach (RDMA) and an effective e-h potential, which enable to derive analytical expressions for the WPQWs electrooptical functions. Choosing the absorption, we performed numerical calculations appropriate to a GaAs/GaAlAs WPQWs. We have obtained a red shift of the absorption maxima (Quantum Confined Stark Effect), asymmetric upon the change of the applied field (F→ -F), parabolic for the ground state and strongly dependent on the confinement parameters (the QWs sizes), changes in the oscillator strengths, and new peaks related to the states with different parity for electron and hole. We performed numerical computations for WPQWs GaAs(Well) GaAlAs (barrier) of different sizes obtaining a good agreement with available experimental results. As an numerical example, we present in Fig. 1 the absorption for two WPQWs with width L=51 nm and L=32.5 nm, respectively, exhibiting in both cases a considerable number of new states when the electric field is applied.

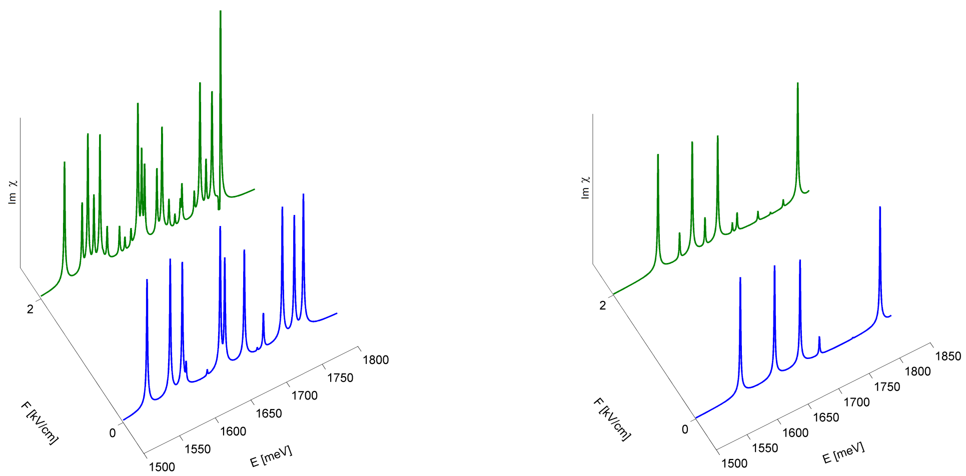

Figure 1: *Absorption spectrum of GaAs/GaAlAs WPQW with L=51 nm and L=32.5 nm, with and without applied electric field.*

References

[1] G. Czajkowski, S. Zielińska-Raczyńska, D. Ziemkiewicz, http://arxiv.org/abs/1502.05329 (2015).

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