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Kinetics and Fluctuations of Electron-Photon Processes in Conductors

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Abstract: *This article is about the kinetics and electron-photon processes in conductors and how they act in reality.*

Keywords: *Kinetics, electronic-photonic processes, conductor, charge, electronic circuits.*

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In heterostructures, due to the difference in the band gap of two semiconductor materials, a potential barrier arises that restricts the movement of charge carriers in a direction perpendicular to the transition plane. As a result, the system becomes quasi-two-dimensional (2B) with an energy spectrum consisting of a set of dimensional quantization zones. One of the most important examples of semiconductor heterostructures are quantum wells. They implement the dimensional limitation of carriers in a thin (up to several lattice constants) layer of a narrow-band semiconductor placed between two layers of substances with wide bandgap zones. In III-V heterostructures, the lowest energy feature in the absorption spectrum of the QE corresponds to an exciton formed from an electron and a heavy hole from the lowest dimensionally quantized subzones. Due to the higher binding energy and oscillator strength, excitons in QY are observed even at room temperature. The latter allows the use of QE in numerous applied developments. At the same time, the quality of a semiconductor device and its characteristics are directly related to the structural perfection of the crystal, which in the case of QE can be evaluated by studying the mechanisms of relaxation, scattering and radiative recombination of an electron-hole system. Therefore, in addition to the fundamental nature of studying processes in conditions of reduced dimensionality, the study of 20 electron-hole systems is also conducted in search of the optimal structure option for subsequent application.

In recent years, the movement towards miniaturization and improved performance of integrated electronic circuits has stimulated tremendous efforts by researchers around the world. However, miniaturization and high-speed electronic circuits lead to unacceptably high levels of energy dissipation. In an attempt to find further ways of development, scientists are increasingly turning to light as a medium of information in their research. This is due to the advantages of photons over electrons: a higher propagation velocity in matter, a larger volume of information transferred per unit of time, less sensitivity to various kinds of interactions. In this regard, it is relevant to study the optical properties of objects, on the basis of which elements of new information networks are being developed.

One of these objects is a semiconductor microresonator (MR), which, like QE, can be attributed to the class of semiconductor heterostructures. In MR, using two dielectric Bragg mirrors, the dimensional limitation of light in the resonator working body is realized, which leads to a high spectral and spatial concentration of the energy of the resonator optical mode. By placing the active medium in the antinode of the electromagnetic field between the mirrors, it is possible to achieve a high degree of mixing of the spontaneous radiation of the medium substance with the resonator mode, which makes it possible to implement lasers based on semiconductor MR with a very low threshold value of the injection current corresponding to the transition to stimulated radiation.

Microresonators with quantum wells in the active layer are also of great interest for fundamental research. The exciton-photon interaction in MR strongly modifies the optical properties of the electron-hole (ED) system. Unlike bulk crystals, where mixed exciton-photon states were first discovered, gigantic values of Rabi splits are observed in microresonators due to the low-dimensional nature of the polariton states. The short intrinsic lifetime of microresonator polaritons, associated with a violation of translational symmetry, leads to a high intensity of polariton peaks in the luminescence and reflection spectra. This makes it possible to conduct an experimental study of the interaction of matter and the electromagnetic field using standard optical techniques.

References

1. Enshteyn ELL. Vozdeystvie sil'noy elektromagnitnoy volni na elektronnie svoystva poluprovodnikov. - Izv. vuzov, Radiofizika, 1975 , t. 18, № b, s. 785-811.
2. Ivchenko Ye.L., Pikus G.E. Fotogal'vanicheskiy effekt v poluprovodnikax. V kn.: Problemi sovremennoy fiziki. L.: Nauka, 1980, s. 275-293.
3. Vir G.L., Pikus G.E. Simmetriya i doformasionnie effekti v poluprovodnikax. M.: Nauka, 1972.
4. Belinicher V.I., Ivchenko Ye.L., Sturman B.I. Kineticheskaya teoriya sdvigovogo fotogal'vanicheskogo effekta v p'ezoelektri-kax. JETF, 1982, t. 83, Sh 8, s. 649-661.