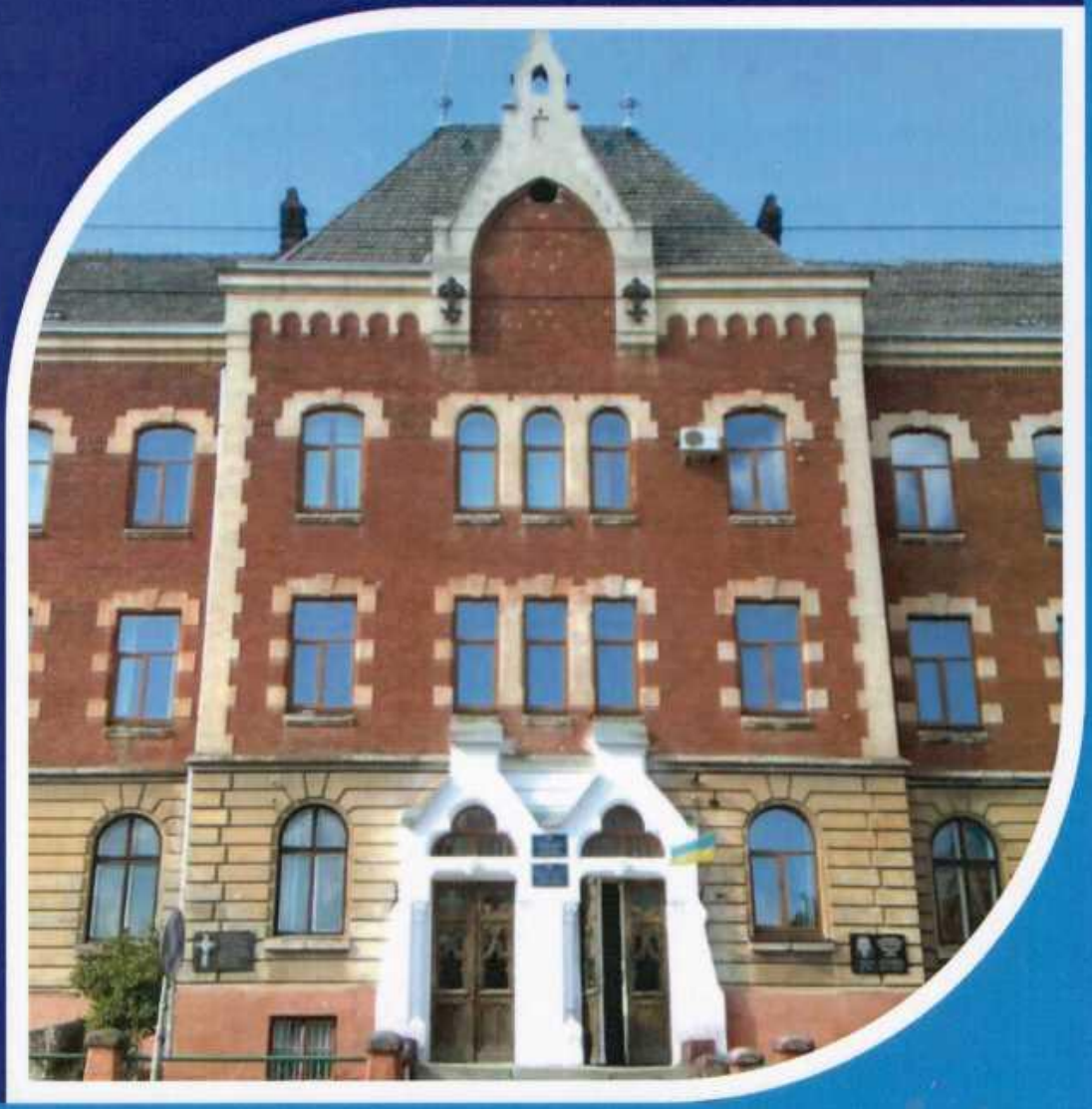
MATERIALs of Conference

XI-th International Conference

Topical Problems of Semiconductor Physics



Drohobych, UKRAINE

May 27-31, 2024

Ministry of Education and Science of Ukraine

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**Scientific Council "Semiconductor and Dielectric Physics"
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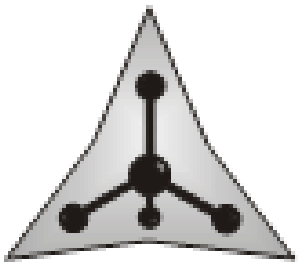
Drohobych Ivan Franko State Pedagogical University

XI-th International Conference

TOPICAL PROBLEMS OF SEMICONDUCTOR PHYSICS



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Actual problems and important achievements of modern semiconductors physics are presented in the Proceedings of the XI-th International Conference “Topical Problems of Semiconductors Physics”. The abstracts are grouped into 7 sections, according to the Conference Thematic: “Section A. New frontiers in semiconductors and their based structures for electronics, optoelectronics, spintronic and sensing”, “Section B. Semiconductor low-dimensional structures: advances in synthesis, characterization, theoretical modeling and applications”, “Section C. The semiconductors for LEDs, solar and related energy technologies and sensor materials”, “Section D. Synthesis, processing and characterization of multifunctional oxide materials”, “Section E. Advanced strategies for smart functional and multifunctional bionanomaterials and biointerfaces”, “Section F. Laser material processing: from fundamental interactions to innovative applications”, “Section G. Modern computational methods and their applications in materials science: Synergy of theory and experiment”. The Proceedings were prepared for publication by the Conference Program Committee and presented in the author’s edition.

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Spectral parameters of an electron in double quantum rings in magnetic and electric fields

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Multilayer semiconductor nanostructures have been studied both theoretically and experimentally for quite a long time. The unique properties of quasiparticles in such systems allow them to be used as basic elements in modern nanoelectronic devices: tunnel nanodiodes, nanolasers, nanodetectors [1, 2].

The work investigated the influence of magnetic and electric fields on the energy spectrum of the electron and the oscillator strengths of quantum intraband transitions in double semiconductor quantum nanorings. To find the energy spectrum and wave functions of the electron, the stationary Schrödinger equation is solved in a cylindrical coordinate system. Such an equation cannot be solved exactly. Therefore, the spectrum of the electron interacting with the electric and magnetic fields in the nanorings was found by the method of decomposing the unknown wave function of the electron by the full orthonormal set of wave functions of the quasiparticle in the nanostructure in the absence of fields and solving the resulting secular equation.

It is shown that in a magnetic field the degeneracy of the electron energy spectrum in terms of the quantum magnetic number, which occurs in an arbitrary cylindrical nanosystem in the absence of a field, is removed. Depending on the magnitude of the magnetic field induction, states with negative quantum numbers periodically become the ground state of the electron in double nanorings. This feature is a peculiar manifestation of the Aharonov-Bohm effect.

It is shown that the electric field significantly changes the density distribution of the probability of finding a quasiparticle in a nanosystem. Thus, if without a field in the ground state the electron is in the inner ring, then with an increase in the electric field strength, the quasiparticle tunnels into the outer nanoring.

The electron energies and oscillator strengths of quantum intraband transitions depend non-monotonically on the strength of the electric field and induction of the magnetic field.

1. Young Joon Hong, Rajendra K. Saroj, Won Park, Gyu-Chul Yi // APL Mater. – 2021. – V. 9. – P. 060907.
2. M. Zervos // Nanoscale Research Letters. – 2014. – V. 9. – P. 509.

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