

Course syllabus

“Supersymmetry in quantum mechanics”

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[2.5 ECTS credits]

I. Superalgebra

1. Generators of supersymmetry.
2. General structure of superalgebras.
3. Doubly degeneration of energy levels.
4. The simplest supersymmetric systems.
5. Symmetry of two-dimensional harmonic oscillator. Charges and supercharges.
6. Supergroup.

II. Supersymmetric quantum mechanics

1. Supersymmetry and switch-on of interaction.
2. Matrix realization of fermionic degrees of freedom.
3. Superpotential.
4. Energy of the vacuum and topology of superpotential.
5. Factorization of Hamiltonian and supersymmetry.
6. Relation of wave functions of supersymmetric partners.
7. Exact calculation of wave functions and energy spectrum with the help of supersymmetry.
8. Shape-invariant potentials.
9. Supersymmetric quantum mechanics with two bosonic degrees of freedom.

III. Supersymmetry in some problems of quantum mechanics

1. Electron in magnetic field. Two-dimensional case.
2. Ground state of the electron in a magnetic field.
3. Electron in three-dimensional magnetic field.
4. Supersymmetry of Dirac equation.
5. Supersymmetry of Coulomb field.
6. Supersymmetry of isotropic oscillator.