The program of the course
Introduction to the theory of integrable systems

Lecturer: A.S. Sorin
Lectures – 34 hours 10 semester

Annotation

Special course serves as an introduction into the fast developing field of modern mathematical physics – theory of discrete and continuous integrable systems of dynamical equations. These systems are met in different parts of modern theoretical physics, determining the actuality of their study. From the listeners of the course the knowledge is demanded of the linear algebra, complex analysis, differential and integral calculus, elements of the differential geometry, Hamilton dynamics, and the theory of groups.

Lecture 1. Poisson structures and Hamilton systems.

Lecture 2. Reduction of Hamilton systems with symmetries.

Lecture 3. Completely intergable systems on sympectic varieties.

Lecture 4. Liouville theorem and the "action-angle" variables.

Lecture 5. Lax representation, linear system and hierarchy of compatible integrable equations.

Lecture 6. Zero curvature representation.

Lecture 7. r-matrix method and the classical Yang-Baxter equations.

Lecture 8. Generalized Toda lattice.

Lecture 9. Periodic Toda chain.

Lecture 10. Calogero-Moser systems.

Lecture 11. Algebra of pseudo-differential operators, Baker-Akhiezer function, tau-function and Hirota equations.

Lecture 12. Generalized Drifield-Sokolov reductions and an algebraic method of constructing integrable hierarchies (dressing method).

Lecture 13. Compatible Hamiltonian structures and recursion operators.

Lecture 14. Kadomtsev-Petviashvili hierarchy and its reductions.

Lecture 15. Korteweg-de Vries hierarchy of equations.

Lecture 16. Non-linear Schrodinger equation hierarchy.

Lecture 17. Classical method of the inverse scattering problem.