DYNAMICAL ASTRONOMY

- Basic elements of the theory of orbits: motion in a central force field. Orbits in axisymmetric gravitational potentials and in potentials given by a multipole spherical harmonics expansion. Charged particle orbits in non-homogeneous magnetic fields.
- Elements of the theory of Hamiltonian dynamical systems: Action - angle variables. Canonical Transformations. The method of Lie generating functions. Reduction to the Birkhoff normal form. Resonances. Approximate integrals of motion and adiabatic invariants. Periodic orbits - types of stability, invariant manifolds - Homoclinic and Heteroclinic Chaos. Bifurcation theory.
- Dynamics of small bodies in the solar system: restricted three body problem. Hill sphere and Hill problem. Motion in the neighborhood of the unstable Lagrangian points and manifold dynamics. Motion near the stable Lagrangian points. Mean Motion resonances. Secular resonances. Applications of astrodynamics.
- Dynamics of (extra-) solar system: General problem of three bodies and of N bodies. Secular theory of variations of Laplace - Lagrange. Mean Motion Resonances. Apsidal Corotation Resonances. Categories of extrasolar planetary systems. Non-gravitational forces, evolution of planetary discs. Elements of planet formation.
- Dynamics of stellar systems: distribution function. Jeans theorem - Virial theorem. Dynamical models and orbits in triaxial galactic systems. Orbits and resonances in galactic discs. Stellar dynamics in the Milky way.