Geometry of Hamiltonian superintegrable systems

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(locals may attend the talk in M.G.004)
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Integrability of a Hamiltonian system on 2d-dimensional manifolds is often identified with `complete' or `Liouville' integrability: the existence of d integrals in involution or, geometrically, the existence of a fibration by invariant d-dimensional, Lagrangian tori. However, very important mechanical Hamiltonian systems (Kepler, central forces, the Euler top, resonant oscillators, etc., i.e. many of the systems classical mechanics has been built upon!) do not naturally fit into this description because, due to the existence of large symmetry groups, they possess $k > d$ first integrals and, correspondingly, their motions are linear on invariant isotropic tori of dimension $n = 2d-k < d$.

A theory that describes all cases, with tori of dimension n between 1 (periodic motions) and d (complete integrablity) has been developed by Nekhoroshev and Mischenko and Fomenko in the 1970's. The resulting fibration by isotropic tori, studied by Dazord and Delzant in the 1980's, has a very rich symplectic geometry, involving the existence of isotropic-coisotropic `bifibrations' or `dual pairs'. This talk gives an introduction to these topics.