Singular forms in Geometry and Dynamics

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In this talk I will present a desingularization technique for symplectic (and contact) structures with singularities which appear modelling some problems in Celestial Mechanics and describe several applications to the study of their so-called Hamiltonian Dynamics.

In these motivating examples the singularities are associated to the line at infinity or collision set and are an outcome of regularization techniques. The desingularization technique ("deblogging") associates a family of symplectic structures to singular symplectic structures with even exponent (the so-called b^{2k}-symplectic structures) and a family of folded symplectic structures for odd exponent (b^{2k+1}-symplectic structures) and has good convergence properties. This procedure generalizes to the odd-dimensional counterpart (singular contact manifolds) and puts in the same picture different geometries: contact and symplectic geometry and singular contact and symplectic geometry.

The applications of this "desingularization kit" comprise the construction of action-angle coordinates for integrable systems, the study of their perturbation (KAM theory) and the existence of periodic orbits.