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Singular reduction of Poisson spaces

We consider a proper action of the symmetry group G of a Poisson manifold P. The orbit space $S = P/G$ is a differential space locally diffeomorphic to a subset of the Cartesian space. The ring of smooth functions on S is a Poisson algebra isomorphic to the algebra of smooth G-invariant functions on P.

We describe the structure of S directly in terms of derivations of the Poisson algebra of S. Orbits of the family of derivations that generate local one-parameter groups of local diffeomorphisms of S give rise to a stratification of S by Poisson manifolds. Orbits of the family of inner derivations define a singular symplectic foliation of S.

We extend our analysis of singular reduction of symmetries to subcartesian Poisson spaces.