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Title: Singularities of symplectic reductions

Abstract: Let V be a unitary representation of the compact Lie group K where K has Lie algebra $\mathfrak{k}$. Then there is a canonical moment mapping $\mu\colon V \to \mathfrak{k}^*$ which is equivariant with respect to the K-actions on V and $\mathfrak{k}^*$. Let M denote the zero set of μ and let M_0 (the symplectic reduction) denote the quotient space M/K which is a real semi-algebraic set. In most cases the algebra of regular functions A on M_0 is isomorphic to the restriction of $\mathbb{R}[V]^K$ to M. Note that if K is finite, then $\mu = 0$, $M_0 = V/K$ and often one has that $\mathbb{R}[V]^K$ is Gorenstein. We investigate algebraic properties of A and M_0 and consider the following questions.

1. Is there a finite group H and unitary H-module W such that $M_0 \simeq W/H$? In other words, when is M_0 an orbifold?

2. Let X denote the complexification of M_0. When does X have rational singularities? When does X have symplectic singularities? When does X have Gorenstein singularities?