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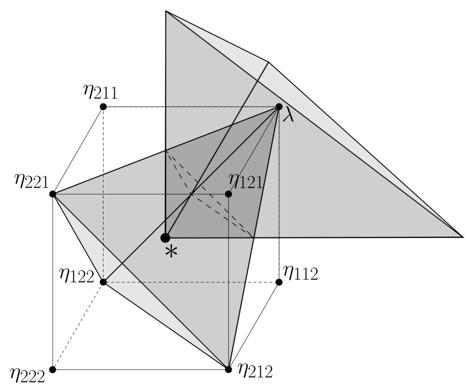

ON THE NON-CONVEXITY OF MOMENTUM IMAGES AND PROJECTIVE GEOMETRY

Abstract. Momentum maps are prominent objects in the theory of group actions, with an important role in invariant theory and interpretations in quantum physics. The most classical situation is that of a compact group K acting linearly on a Hilbert space V, representing the symmetry group of a quantum system with state space V. The eigenvalues of the group elements are related to the energy levels of the system. The momentum map is in a sense designed to collect these eigenvalues. Therefore its image is of utmost importance and has been studied for a long time. Despite the abundance of results, there lacks a comprehensive description of the momentum images of all irreducible representations. Some of the general theorems are notoriously nonconstructive, while many constructive methods apply under special hypotheses. Ironically perhaps, some of the most difficult cases are classical, e.g. the fundamental representations of $K = SU(n)$ acting on some exterior power $V = \Lambda^j\mathbb{C}^n$, representing in physics a system of j fermions.

I will discuss the phenomena causing the difficulty in the context of projective algebraic geometry. It turns out that several geometric constructions, like Gaussian fundamental forms, osculating varieties and secant varieties to complex K-orbits, admit interesting momentum interpretations. I will also discuss applications to the study of the ring of invariant polynomials $\mathbb{C}[V]^K$.

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Valdemar Tsanov obtained his Ph.D. in Mathematics from Queen's University in 2011. After a postdoctoral position at the Ruhr-Universität in Bochum (2011 – 2014), he is currently a postdoctoral fellow at Universität Göttingen. Dr. Tsanov's research focuses on Lie theory, homogeneous spaces, interactions between geometry and representation theory.

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