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Gaussian quantum information over general kinematical systems

Mathematically, quantum kinematical systems with finitely many degrees of freedom are described by a locally compact abelian group G and a cocycle. The cocycle induces a symplectic (i.e., phase space) structure on $G \times \widehat{G}$, which encodes the canonical commutation relations of the associated (projective) Weyl representation. Such abstract quantum kinematical systems have been studied from a variety of perspectives, including finite-dimensional approximations, uncertainty relations and generalized metaplectic/Clifford operators. In this work, we continue this program by developing a formalism to study Gaussian states and channels for general quantum kinematical systems.

I will quickly review the phase space formulation for bosonic/qudit systems and discuss its generalization to abstract (2-regular) Weyl systems. I will then introduce Gaussian states and channels for abstract Weyl systems and discuss some of our main results, including a complete characterization of Gaussian states for arbitrary Weyl systems, and single letter formulae for the quantum capacities and minimum output entropies for arbitrary Gaussian channels over finite Weyl systems.