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Symmetry Reduction in Multiparty Quantum States

Symmetries are ubiquitous in natural phenomena and also in their mathematical descriptions and according to a general principle in Mathematics, one should exploit a symmetry to simplify a problem whenever possible. In this talk, we focus on elimination of continuous symmetries from multi-particle quantum systems and discuss that the existing methods equip us with a powerful set of tools to compute geometrical and topological invariants of the resulting reduced spaces. As an intermediate step, we consider the maximal torus subgroup T of the compact Lie group of Local Unitary operations K and elaborate on the symmetry reduction procedure and use methods from symplectic geometry and algebraic topology to obtain some of the topological invariants of these relatively well-behaving quotients for multi-particle systems containing r qubits. We elaborate on an explicit example with two qubits and discuss further implications in quantum information theory.