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Recent developments on state conversion theory in the resource theory of asymmetry for finite groups and compact Lie groups

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概　要

Symmetry is one of the most significant foundational principles underlying nature. The resource theory of asymmetry (RTA) is a resource-theoretic framework for investigating asymmetry as a resource to break constraints imposed by symmetries. It has recently undergone significant developments, resulting in applications in a variety of research areas including quantum thermodynamics, coherence distribution, quantum computations, measurement theory, and black hole physics.

Nevertheless, the resource conversion theory at the core of RTA remains incomplete. In the independent and identically distributed (i.i.d.) setup, where identical copies of a state are converted to identical copies of another state, conversion theory among pure states has been completed only for U(1) group and Z_2 group. Here, we establish an i.i.d. conversion theory among any pure states in RTA for any continuous symmetry described by a compact Lie group and any discrete symmetry described by a finite group. Our formulation achieves a unified understanding of conversion rates in prior studies for different symmetries. As a corollary of the formula, we also affirmatively prove the Marvian-Spekkens conjecture on reversible asymptotic convertibility in RTA, which has remained unproven for a decade.

We also report about the recent results on the non-i.i.d. state conversion theory for U(1) symmetry. This talk mainly treats the contents in arXiv:2411.04766 (2024), arXiv:2312.15758 (2023) and Physical Review Letters **131**, 200203 (2023).

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