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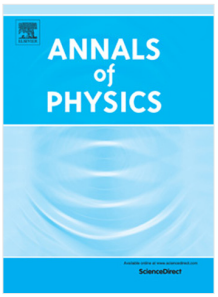

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Operational Resource Theory of Total Quantum Coherence

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Abstract

Quantum coherence is an essential feature of quantum mechanics and is an important physical resource in quantum information. Recently, the resource theory of quantum coherence has been established parallel with that of entanglement. In the resource theory, a resource can be well defined if given three ingredients: the free states, the resource, the (restricted) free operations. In this paper, we study the resource theory of coherence in a different light, that is, we consider the total coherence defined by the basis-free coherence maximized among all potential basis. We define the distillable total coherence and the total coherence cost and in both the asymptotic regime and the single-copy regime show the reversible transformation between a state with certain total coherence and the state with the unit reference total coherence. Extensively, we demonstrate that the total coherence can also be completely converted to the total correlation with the equal amount by the free operations. We also provide the alternative understanding of the total coherence, respectively, based on the entanglement and the total correlation in a different way.

Keywords: operational resource theory, total quantum coherence, transformation between states

1. Introduction

Quantum coherence is the essence of the interference phenomena and is the most fundamental feature in quantum mechanics. It is closely related to

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