Emergent Gauge Symmetries and Quantum Operations.

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Abstract

The algebraic formulation of quantum mechanics codify the foundation of this theory. In this context, a problem is to assign an entropy to an algebraic state. It has been proposed to solve it using the GNS construction (Balachandran et al., Phys. Rev. Lett. 110, 080503 (2013)) which has proved to be useful in the study of entanglement properties of identical particles. But this assignment is ambiguous. In this work we characterize this ambiguity through Tomita-Takesaki modular theory, allowing a natural interpretation of this phenomenon through an emergent gauge symmetry implemented by a entropy increasing quantum operation. The above is obtained for any finite dimensional physical system, associating the notion of subsystems with subalgebras. The relation to the usual known purification of bipartite systems is also presented through an example.

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