Entanglement Asymmetry in non-Abelian Anyonic Systems

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Abstract

Non-Abelian anyons, a promising platform for fault-tolerant topological quantum computation, adhere to the charge super-selection rule (cSSR), which imposes restrictions on physically allowed states and operations. However, the ramifications of cSSR and fusion rules in anyonic quantum information theory remain largely unexplored. In this study, we unveil that the information-theoretic characteristics of anyons diverge fundamentally from those of non-anyonic systems such as qudits, bosons, and fermions and display intricate structures. In bipartite anyonic systems, pure states may have different marginal spectra, and mixed states may contain pure marginal states. More striking is that in a pure entangled state, parties may lack equal access to entanglement. This entanglement asymmetry is manifested in quantum teleportation employing an entangled anyonic state shared between Alice and Bob, where Alice can perfectly teleport unknown quantum information to Bob, but Bob lacks this capability. These traits challenge conventional understanding, necessitating new approaches to characterize quantum information and correlations in anyons. We expect that these distinctive features will also be present in non-Abelian lattice gauge field theories. Our findings significantly advance the understanding of the information-theoretic aspects of anyons and may lead to realizations of quantum communication and cryptographic protocols where one party holds sway over the other.

Venue

PAMU Seminar Room

A.N. Kolmogorov Building, ISI, Kolkata

Date & Time

29th July, 2024
03:00 PM

Everyone is invited to attend