Comments on defining entanglement entropy. (English) Zbl 07398677

Summary: We revisit the issue of defining the entropy of a spatial region in a broad class of quantum theories. In theories with explicit regularizations, working within an elementary but general algebraic framework applicable to matter and gauge theories alike, we give precise path integral expressions for three known types of entanglement entropy that we call full, distillable, and gauge-invariant. For a class of gauge theories that do not necessarily have a regularization in our framework, including Chern-Simons theory, we describe a related approach to defining entropies based on locally extending the Hilbert space at the entangling edge, and we discuss its connections to other calculational prescriptions. Based on results from both approaches, we conjecture that it is always the full entanglement entropy that is calculated by standard holographic techniques in strongly coupled conformal theories.

MSC:
81P42 Entanglement measures, concurrences, separability criteria
81R15 Operator algebra methods applied to problems in quantum theory
81S40 Path integrals in quantum mechanics
81P48 LOCC, teleportation, dense coding, remote state operations, distillation
58J28 Eta-invariants, Chern-Simons invariants
81T40 Two-dimensional field theories, conformal field theories, etc. in quantum mechanics

Full Text: DOI

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