

Quantum Physics

Monotonicity of the Holevo quantity: a necessary condition for equality in terms of a channel and its applications

M. E. Shirokov

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A condition for reversibility (sufficiency) of a channel with respect to a given countable family of states with bounded rank is obtained.

This condition shows that a quantum channel preserving the Holevo quantity of at least one (discrete or continuous) ensemble of states with rank $\leq r$ has the r -partially entanglement-breaking complementary channel. Several applications of this result are considered. In particular, it is shown that coincidence of the constrained Holevo capacity and the quantum mutual information of a quantum channel at least at one full rank state implies that this channel is entanglement-breaking.

Comments: 28 pages, the reversibility condition has been specified, generalizations to infinite dimensions including the case of continuous ensembles and several their applications have been added

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