

The decoupling theorem

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If a quantum system A , which is initially correlated to another system, E , undergoes an evolution separated from E , then the correlation to E generally decreases. Here, we study the conditions under which the correlation disappears completely, resulting in a decoupling of A from E . We give a criterion for decoupling in terms of two smooth entropies, one quantifying the amount of initial correlation between A and E , and the other characterizing the mapping that describes the evolution of A . The criterion applies to arbitrary such mappings and is tight if the mapping satisfies certain natural conditions. Decoupling has a number of applications both in physics and information theory, e.g., as a building block for quantum information processing protocols. We will give two simple examples of how the decoupling theorem can be used.

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