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Quantum correlations in remote state creation. Information exchange with vanishing entanglement.

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The formation and evolution of quantum correlations is one of the central problems of quantum information. Although quantum correlations are necessary to provide advantages of quantum information devices in comparison with their classical counterparts, the appropriate measure of these correlations is not well-established yet. Quantum entanglement [1] was considered as a suitable measure for a long time. However, recently the quantum discord was introduces [2,3] as an alternative measure which can be valuable in systems with vanishing entanglement.

We assume that quantum correlations can be classified (with possible overlaps among different classes) so that a given quantum process is governed by a certain class of quantum correlations rather than by all of them. In our work we are aimed on revealing those quantum correlations that are responsible for remote creation of a one-qubit state in a spin chain [4], which is the further development of the problem of end-to-end quantum state transfer along a spin chain [5].

We study the dependence of quantum correlations between the two remote qubits (sender and receiver) connected by a transmission line (homogeneous spin-1/2 chain) on the parameters of the sender's and receiver's initial states (control parameters) [6]. We consider two different measures of quantum correlations: the entanglement [1] (a traditional measure) and the informational correlation [7] (based on the parameter exchange between the sender and receiver). We find the domain in the control parameter space yielding (i) zero entanglement between the sender and receiver during the whole evolution period and (ii) non-vanishing informational correlation between the sender and receiver, thus showing that the informational correlation is responsible for the remote state creation. We demonstrate that, among the control parameters, there are the strong parameters (which strongly effect the values of studied measures) and the weak ones (whose effect is negligible), therewith the eigenvalues of the initial state are given a privileged role. We also show that the problem of small entanglement (concurrence) in quantum information processing is similar (in certain sense) to the problem of small determinants in linear algebra. The particular model of the 40-node spin-1/2 communication line is presented.

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Short biography note

My short biography is following.
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