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**Title:**

Nonlinear map in probability representation as purification method of qubit states

**Abstract:**

We consider the action of the nonlinear map of special type on the density matrix of a qubit in probability representation. The representation recently introduced in [1] allows expressing the density matrices in terms of classical probabilities which obey specific inequalities. Thus, one can formulate quantum mechanics in classical-like fashion. We hope that such a representation will help to understand better different transformations of density matrices, for example, during various processes. The novelty of the work is that we give an explicit expression of the nonlinear map in terms of the probabilities. The similar map was considered in [2, 3]. We generalize and complement the results obtained by V. I. Man'ko and R. S. Puzko. In our work we use the map of density matrices, which is similar to the evolution in [4], with the parameter of the map playing the role of time. The significance of the work is that we showed that the map leads to the purification of the initial state in the sense that it increases its purity parameter (the state which is invariant under the action of the map is an exception). Thus, the geometrical representation of the nonlinear map is that it moves the points of the state space to the surface of the Bloch ball except for the invariant state.

**Bibliography:**

- [1] Chernega V. N., Manko O. V. and Manko V. I., JRLR, **38** (2017) 141; 416; arXiv preprint :1712.01927.
- [2] Man'ko V. I. and Puzko R. S., EPL, **109** (2015) 50005.
- [3] Manko V. I. and Puzko R. S., JRLR, **35** (2014) 362.
- [4] Peixoto de Faria J. G. *et. al.*, EPL, **62** (2003) 782.