MEASUREMENT-INDUCED NONLOCALITY FOR AN ARBITRARY BIPARTITE STATE

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Measurement-induced nonlocality is a measure of nonlocality introduced by Luo and Fu [Phys. Rev. Lett 106, 120401 (2011)]. In this paper, we study the problem of evaluation of Measurement-induced nonlocality (MIN) for an arbitrary $m \times n$ dimensional bipartite density matrix $\rho$ for the case where one of its reduced density matrix, $\rho^a$, is degenerate (the nondegenerate case was explained in the preceding reference). Suppose that, in general, $\rho^a$ has $d$ degenerate subspaces with dimension $m_i$ ($m_i \leq m, i = 1, 2, ..., d$). We show that according to the degeneracy of $\rho^a$, if we expand $\rho$ in a suitable basis, the evaluation of MIN for an $m \times n$ dimensional state $\rho$, is degraded to finding the MIN in the $m_i \times n$ dimensional subspaces of state $\rho$. This method can reduce the calculations in the evaluation of MIN. Moreover, for an arbitrary $m \times n$ state $\rho$ for which $m_i \leq 2$, our method leads to the exact value of the MIN. Also, we obtain an upper bound for MIN which can improve the ones introduced in the above mentioned reference. Finally, we explain the evaluation of MIN for $3 \times n$ dimensional states in details.

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1. Introduction

Quantum mechanics is a nonlocal theory. The principle of locality states that the properties of one particle can not be affected by another particle that is sufficiently far away. Nonlocality in quantum mechanics has at least two different aspects [1]. One of these aspects arises in the Aharonov-Bohm effect. The Aharonov-Bohm effect is nonlocal in the sense that the