Erratum: "Entropy inequalities and Bell inequalities for two-qubit systems" [Phys. Rev. A 69, 022305 (2004)]

Emilio Santos

(Received 29 June 2004; published 3 November 2004)

DOI: 10.1103/PhysRevA.70.059901 PACS number(s): 03.67.−a, 03.65.Ud, 99.10.Cd

Theorems 1 and 2 of this paper do not give correct bounds. In fact the steps going from Eq. (15) to Eq. (17) were wrong. I thank L. Jakóbczyk for pointing out the error.

The correct bounds may be stated as

Theorem 1. In a two-qubit system, a sufficient condition for the fulfilment of all CHSH inequalities is that the linear entropy of the state fulfils $S_{12} \geqslant \frac{1}{2}$. For any smaller value of S_{12} there are states able to violate the inequalities.

Theorem 2. In a two-qubit system, a sufficient condition for the fulfilment of all CHSH inequalities is that the sum of the conditional linear entropies of the state fulfils $S_{1/2}+S_{2/1} \geqslant 0$. For any negative value of the sum there are states able to violate the inequalities.

The first part of Theorem 1 follows from Eq. (11) of [1]. The first part of Theorem 2 was proved in Ref. [2]. The second part of either theorem follows from the existence of a Bell operator, B, with eigenvalues $\{\xi_j\}$ labelled so that

$$\xi_1 > \xi_2 = \sqrt{8 - \xi_1^2} \geqslant 0, \xi_3 = -\xi_2, \xi_4 = -\xi_1,$$

and a state whose density matrix, written in the basis of eigenvectors of B, has elements

$$r_{11} = \frac{\xi_1}{\xi_1 + \xi_2}, r_{22} = \frac{\xi_2}{\xi_1 + \xi_2}, r_{ij} = 0 \text{ otherwise}.$$

This state possesses reduced density matrices which are both multiple of the unit matrix.

[1] E. Santos, Phys. Rev. A **69**, 022305 (2004).

[2] E. Santos and M. Ferrero, Phys. Rev. A **62**, 024101 (2000).

