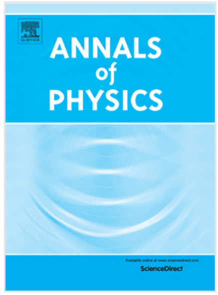
Accepted Manuscript



Reassessment of the nonlocality of correlation boxes

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PII: S0003-4916(16)30293-7
DOI: http://dx.doi.org/10.1016/j.aop.2016.12.023
Reference: YAPHY 67285

To appear in: *Annals of Physics*

Received date: 22 August 2016
Accepted date: 8 December 2016

Reassessment of the nonlocality of correlation boxes

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Abstract

Correlation boxes are hypothetical systems usually designed to produce the maximal algebraic violation of a Bell inequality, beyond the quantum bound and without superluminal signalling. The fact that these systems show stronger correlations than those presented by maximally entangled quantum states, as the spin singlet, has been regarded as a demonstration that the former are more nonlocal than the latter. By applying an alternative, consistent measure of nonlocality to a family of correlation boxes, we show that this conclusion is not necessarily true. Complementarily, we define a class of systems displaying subquantum correlations which, nevertheless, are more nonlocal than the singlet state, showing that the extent of the numeric violation of an inequality may have little to do with the degree of nonlocality, especially in the case of correlation boxes.

Keywords: Bell nonlocality, correlations
PACS: 03.65.Ud, 03.65.Ta

1. Introduction

To come to grips with quantum nonlocality is a challenging program, the difficulty being at least twofold. In the first place, Bell nonlocality depends upon entanglement, which is by itself very difficult to characterize. Secondly, differently from entanglement, supplementary information on how nonlocality is to be inferred seems to be always necessary. This difference comes from the fact that entanglement can be defined and investigated in purely mathematical terms, while nonlocality can be seen as one of the physical manifestations of entanglement in the tangible world.

The lack of this perception may lead to misleading assertions as, for example, the claim that a certain two-qubit state ρ is Bell local because it does