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On Bell's Inequality in PT-Symmetric Quantum Systems

Sarang Bhosale [1], Biswanath Rath [2] and Prasanta K. Panigrahi [1,*]

[1] Indian Institue of Science Education and Research, Kolkata; sarangbhosale11@iiserkol.ac.in
[2] Maharaja Sriram Chandra Bhanja Deo University, Barupada, Odisha; biswanathrath10@gmail.com
* Correspondence pprasanta@iiserkol.ac.in

Abstract: Bell's inequality is investigated in PT-symmetric quantum mechanics, using a recently developed and more straightforward form of the inequality by Maccone [Am. J. Phys. 81, 854 (2013)], with two PT-symmetric qubits in the unbroken phase. It is shown that the inequality produces a bound that is consistent with the standard quantum mechanics. Therefore, further, it implies that entanglement invariance is not violated in the PT-symmetric formulation of quantum mechanics. The no-signaling principle for a two-qubit system in PT-symmetric quantum theory is preserved. Consequently, it becomes clear that Bell's inequality is a potent tool as the bound obtained is independent of the internal intricacies of the theory except for the assumptions of locality and realism. To enforce our understanding of the broken PT-symmetric case, we study different types of inner product structures in the regimes of frame theory, i.e., by using the concept of bi-orthogonality and recently developed form of the inner product in pseudo-Hermitian systems [J. Math. Phys. 51, 042103 (2010)].

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