

Diego Frustaglia

FRIAS / University Sevilla

The bounds of quantum correlations in classical contexts

Abstract: The particular set of numerical bounds satisfied by quantum correlations has been intensively studied as a plausible gateway to the first principles of quantum theory, which up to date remain elusive. Here we show that these bounds are indeed not exclusive to quantum theory: for any abstract correlation scenario with compatible measurements, models built on classical waves produce events with probability distributions indistinguishable from those of quantum theory and, therefore, share the same bounds. We demonstrate this by implementing classical microwaves that propagate along meter-size transmission-line circuits, reproducing the probabilities of three emblematic quantum experiments [1]. Our results show that the "quantum" bounds would also occur in a classical universe without quanta, where classical fields would be the fundamental physical objects. This has several implications to be discussed [2].

[1] D. Frustaglia, J. P. Baltanás, M. C. Velázquez-Ahumada, A. Fernández-Prieto, A. Lujambio, V. Losada, M. J. Freire, and A. Cabello, Phys. Rev. Lett. 116, 250404 (2016).

[2] L. Zyga, 'Quantum' bounds not so quantum after all, Phys.org (July 1st, 2016), <https://phys.org/news/2016-07-quantum-bounds.html>.