Quantum nonlocality based on finite-speed causal influences leads to superluminal signalling

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The results observed when measuring two entangled quantum particles separated from each other can be correlated in a way that cannot be explained by past causes common to both measurements [1,2]. Still, common causes supplemented by the exchange of influences between distant measurements could explain these results.

Since the measurement events can be space-like separated, any such type of explanation must involve faster than light influences, which could yet remain hidden in the sense of not allowing observable correlations to be used to communicate faster than light. This is what led Abner Shimony to name the situation as "peaceful coexistence" between hidden influences behind the quantum and no signalling at the level of correlations [3].

Here we show that any such model gives, for any finite $v > c$, predictions that can be used to communicate faster than light. This answers a long-standing question on the plausibility of these models [4], on which progress was recently made in [5].

Given that all the correlations we are confronted with in our daily life can be explained by causal influences propagating at a finite speed, this result highlights more than ever the exceptional nature of quantum correlations, and sets the advantage offered by quantum communications and quantum information processing on firmer grounds.

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