

How to explain non-local correlations in entangled states

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One of the most conspicuous features of entangled quantum states is that they give rise to correlations between outcomes of measurements that are insensitive to the spatial distance separating the measurements. The main question formulated in this talk is whether this phenomenon can receive a causal explanation. The underlying assumption will be that causation is best explicated in terms of the Lewisian counterfactual dependence between distinct events. This in turn requires that we decide what semantics of counterfactuals to follow in order to properly describe links between space-like separated events. Several proposals of how to do that will be put forward, and corresponding causal mechanisms responsible for the occurrence of the observed non-local correlations will be given. It will be argued that each causal model of the correlations in entangled states displays some sort of non-classical features, of which explanatory circularity is the most striking. An alternative method of non-causal explanation based on the purported extrinsicity of individual properties in entangled systems will be briefly analyzed and dismissed.