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Neither contextuality nor non-locality admits catalysts

Bell's theorem rules out local hidden-variable theories of quantum mechanics. This is due to the phenomena of non-locality: given n-parties sharing some quantum states, there is no joint probability distribution on all possible measurements that explains the outcomes observed when each party chooses a fixed measurement. Contextuality can be seen as the same phenomenon (i.e. inability to glue pairwise compatible probability distributions into a joint one) without the assumption of spatial separation.

Non-locality of quantum mechanics is often seen as arising from entanglement, but entanglement and non-locality are not quite the same resource. In this talk we discuss one such discrepancy. Entanglement famously allows for catalysts: there are states that can be used to catalyze an otherwise impossible local transformation. More formally, there are quantum states ρ_1, ρ_2 such that no (LOCC-)transformation $\rho_1 \to \rho_2$ exists but $\psi \otimes \rho_1$ can be transformed to $\psi \otimes \rho_2$.

In this talk we show that such catalysts do not exist for contextuality nor for non-locality. To do so, we first recap what contextuality and non-locality are as features of correlations, and then discuss what does it mean to transform such correlations to others. This lets us formalize the no-catalysis result, which states that if there is a transformation $d \otimes e \to d \otimes f$, then there is a transformation $e \to f$ as well.