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Entanglement of overlapping systems and the breakdown of the tensor product MATTHEW LEIFER, Perimeter Institute for Theoretical Physics — Recent work on entanglement in the presence of superselection rules has shown that entanglement ought to be defined operationally, i.e. with respect to sets of local operations actually available to Alice and Bob rather than with respect to an arbitrary tensor product factorization of the state space. Usually Alice and Bob's local operations are assumed to commute, which is an appropriate assumption when their systems are well separated. In this talk I address the question of how far the usual formalism can be maintained if the local operations do not commute. This might be an appropriate description of the spin entanglement between two particles with overlapping spatial wavefunctions, since local operations might then have an effect on both spins. In this situation, the appropriate notion of entanglement is no longer associated to a tensor product factorization of the state space, but it can be approximated by one provided the overlap of the two systems is small and/or the preparable states are sufficiently mixed. In this talk I will present a simple model of the breakdown of the tensor product for two qubits, characterize the states that need to be prepared to observe the effect and discuss how the observed entanglement is related to the entanglement with respect to the usual tensor product factorization.

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