Quantum Entanglement, Interaction, and the Classical Limit

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Two or more quantum systems are said to be in an entangled or non-factorisable state if their joint (supposedly pure) wave-function is not expressible as a product of individual wave functions but is instead a superposition of product states. Only when the systems are in a factorisable state they can be considered to be separated (in the sense of Bell). We show that whenever two quantum systems interact with each other, it is impossible that all factorisable states remain factorisable during the interaction unless the full Hamiltonian does not couple these systems so to say unless they do not really interact. We also present certain conditions under which particular factorisable states remain factorisable although they represent a bipartite system whose components mutually interact. We identify certain quasi-classical regimes that satisfy these conditions and show that they correspond to classical, pre-quantum, paradigms associated to the concept of particle. – PACS number: O3.65.Bz

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