

Quantum entanglement and decoherence

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When a quantum system is entangled with its environment through some interaction, there is no pure state description available for the system even though pure state description of the system plus environment as a whole might be possible. In this case, the system loses its coherence, in other words, is decohered or the decoherence occurred on the system. When the whole is entangled, the part is decohered. The system entangled with environment is not a pure state any more and is called a mixed state, which cannot be described by a ket vector or a state function, but by a density matrix. While the conventional idea for the emergence of classical physics from quantum physics is based on the smallness of planck constant and has nothing to do with the existence of external system or environment, the decoherence idea requires the interaction between the system and its environment.