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# Relative decoherence in quantum reference frames

Reference frames are of special importance in physics. They are usually considered to be idealized entities. However, in most situations, e.g. in laboratories, physical processes are described within reference frames constituted by physical systems. As new technological developments make it possible to demonstrate quantum properties of complex objects an interesting conceptual problem arises: Could one use states of quantum systems to define reference frames? Recently such a framework has been introduced in [F. Giacomini, E. Castro-Ruiz, and Č. Brukner, Nat Commun 10, 494 (2019)]. One of its consequences is the fact that quantum correlations depend on a physical state of an observers reference frame. The aim of this work is to examine the dynamical aspect of this phenomena and show that the same is true for correlations established during an evolution of a composite systems. Therefore, decoherence process is also relative: For some observers the reduced evolution of subsystems is unitary, whereas for others not. I also discuss implications of this results for modern developments of decoherence theory: Quantum Darwinism and Spectrum Broadcast Structures.

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