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The Universal Arrow of Time II: Quantum mechanics case

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This paper is a natural continuation of our previous paper arXiv:1011.4173 . We illustrated earlier that in classical Hamilton mechanics, for overwhelming majority of real chaotic macroscopic systems, alignment of their thermodynamic time arrows occurs because of their low interaction. This fact and impossibility to observe entropy decrease at introspection explain the second law of thermodynamics. The situation in quantum mechanics is even a little bit easier: all closed systems of finite volume are periodic or nearly periodic. The proof in quantum mechanics is in many respects similar to the proof in classical Hamilton mechanics - it also uses small interaction between subsystems and impossibility to observe entropy decrease at introspection. However, there are special cases which were not found in the classical mechanics. In these cases one microstate corresponds to a set of possible macrostates (more precisely, their quantum superposition). Consideration of this property with use of decoherence theory and taking into account thermodynamic time arrows will introduce new outcomes in quantum mechanics. It allows to resolve basic paradoxes of quantum mechanics: (a) to explain the paradox of wave packet reduction at measurements when an observer is included in the system (introspection) (paradox of the Schrodinger cat); (b) to explain unobservability of superposition of macroscopic states by an external observer in real experiments (paradox of Wigner's friend); (c) to prove full equivalence of multi-world and Copenhagen interpretations of quantum mechanics; (d) to explain deviations from the exponential law at decay of particles and pass from one energy level to another (paradox of a kettle which will never begin to boil).

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