Quantum Simplicity - How Complex Systems may be Simplified using Quantum Theory

We understand complex systems around us though predictive modelling – building algorithms that generate future predictions when given relevant past information. Each model encapsulates a way of understanding future expectations through past observations. In the spirit of Occam's razor, the better we isolate the causes of what we observe, the greater our understanding. This philosophy privileges the simpler models; should two models make identical predictions, the one that requires less input information is preferred. Yet, for almost all stochastic processes, even the provably optimal classical models waste information. The amount of input information they demand exceeds the amount of predictive information they output. This waste creates a significant overhead in memory costs when one seeks to use such models to simulate the world around us – one that becomes increasingly prohibitive as we seek to understand ever more complex systems. In this presentation, I outline how we can systematically construct quantum models that surpass these classical limits, and thus the most efficient simulator of general phenomena is necessarily quantum. I survey the consequences of this to complexity theory, where it

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