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Decoherence at the quantum speed limit

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Understanding the rates of consumption for quantum resources is intimately related to the development of truly quantum devices. To this end, several “speed limits” have been formulated that give upper bounds on the rates of quantum evolution. An open question is how these various formulations compare, and which version gives an accurate and practically relevant estimate for how fast resources are consumed. In our work we focus on two of the speed limits, namely the geometric quantum speed limit (QSL) and the resource speed limit (RSL), to measure the rate of consumption of coherence. More specifically, we analyze the dynamics of a qubit that evolves under pure decoherence in both the energy and logical basis. Using the dynamics of the evolution, we compute the QSL and RSL and we find a concise and tight estimate of the rate of decoherence in simple quantum information processing.