

Heat engine driven by purely quantum information

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The key question of this paper is whether work can be extracted from a heat engine by using purely quantum mechanical information. If the answer is yes, what is its mathematical formula? First, by using a bipartite memory we show that the work extractable from a heat engine is bounded not only by the free energy change and the sum of the entropy change of an individual memory but also by the change of quantum mutual information contained inside the memory. We then find that the engine can be driven by purely quantum information, expressed as the so-called quantum discord, forming a part of the quantum mutual information. To confirm it, as a physical example we present the Szilard engine containing a diatomic molecule with a semi-permeable wall.