Nonadiabatic coupled-qubit Otto cycle with bidirectional operation and efficiency gains

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We study a quantum Otto cycle that uses a 2-qubit working substance whose Hamiltonian does not commute with itself at different times during the adiabatic strokes. We show this cycle displays regimes of operation with efficiencies higher than the standard Otto one, counter-rotating cycles operating as heat engines and efficiency that can increase with a decrease in the temperature difference between the baths. We also investigate how the cycle responds to variations in the quantum adiabaticity of its unitary strokes, finding it displays an intense response in its efficiency behavior, and significantly changes the regimes where it operates as an engine