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Quantum Heat Engines Described by a Master Equation with Pumping Terms SANGCHUL OH, Qatar Environment and Energy Research Institute, Hamad bin Khalifa University, Qatar, SABRE KAIS, Qatar Environment and Energy Research Institute, Hamad bin Khalifa University, Qatar; Purdue University — Using master equation approach, we study quantum heat engine models such as solar cells and photosynthetic systems that converts hot thermal radiation into useful works. In contrast with a conventional master equation description that a quantum heat engine is simply coupled with a hot reservoir, we introduce the pumping term in order to take into account absorbed photon flux which makes donors excited.The current-voltage curve of the photocell is obtained by solving the Pauli master equation with the pumping term. We find that the power output of the photocell increases linearly at first, and then becomes saturated as the pumping rate increases. This linear increase in the power output as a function of the pumping rate is similar to the increase in the power output of a conventional solar cell with the light intensity. The pumping term introduced here might resolve the unrealistic assumption of conventional approaches that the quantum heat engine is in thermal equilibrium with the hot reservoir.

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