Towards More Powerful Quantum Heat Engines

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Laser and photocell quantum heat engines (QHEs) are very similar systems when viewed from the standpoint of quantum thermodynamics. The laser QHE (figure 1) is pumped by hot photons and cooled by a lower temperature entropy sink while the photocell QHE (figure 2) is driven by hot photons with the ambient heat reservoir serving as the lower temperature entropy sink. The similarities do not stop there, both systems can have their power enhanced by a factor of two using coherence generated by noise-induced quantum interference. This noise-induced coherence has the advantage over coherence produced by an external microwave field, because it cost no energy to create. Researchers at Texas A&M lead by Dr. Marlan Scully have shown that the induced coherence can, at least in principle, enhance the efficiency of photovoltaic devices such as solar cells.

1. M. O. Scully, K. R. Chapin, K. E. Dorfman, M. B. Kim, A. Svidzinsky (2011) Quantum heat engine power can be increased by noise-induced coherence. PNAS 108:15097-15100