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When do Floquet systems fail to heat?

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Periodically driven quantum systems do not have a conserved energy. Thus, statistical mechanical lore holds that if they thermalize, it must be to infinite temperature. I will first show this holds in undriven systems that satisfy the eigenstate thermalization hypothesis. I will then present two counter-examples to infinite temperature heating. The first is the bosonic $O(N)$ model at infinite N , in which the steady states are paramagnetic and have non-trivial correlations. The second is the Clifford circuit model, which can fail to heat depending on the choice of circuit elements. The resulting steady states can then be localized or delocalized but not ergodic. Such models shed light on the nature of interacting Floquet localization.