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Two forms of heat transfer via interaction with heat bath

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We consider a classical open system in contact with heat bath via interaction Hamiltonian. We investigate two forms of energy transfer via the change of interaction Hamiltonian, which are interpreted as heats. One is heat dissipation from the system and the other is heat absorption by the heat bath, which are usually expected to be the same. Since the change of interaction Hamiltonian leads to the difference between the two heats, the two are not the same in non-stationary period. In non-equilibrium stationary state, the two are only equal to each other in average and may differ in probability distribution. We investigate the difference of the forms of heat for toy models and molecular dynamic systems. It will be an interesting question which is a relevant choice of heat used for the first and second laws of thermodynamics. Further study on open quantum systems will be interesting.

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