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Thermodynamics of Nonequilibrium Systems with Feedback Control

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In modern nonequilibrium physics, "Maxwell's demon" has attracted renewed attentions in both terms of theory and experiment. The demon plays a key role to unify thermodynamics and information theory, which can extract the useful work from a heat bath by using the obtained information via feedback control. In this talk, I will talk about the recent development of thermodynamics of information. In particular, I will focus on the generalizations of the second law of thermodynamics and the Jarzynski equality in the presence of feedback control, where information contents and thermodynamic quantities are treated on an equal footing. I will also discuss recent experimental results that realized Maxwell's demon by colloidal particles and single electrons.