Inferring non-equilibrium thermodynamics in continuously monitored systems: the role of information

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I will put forth a unifying formalism for the description of the thermodynamics of continuously monitored systems, where measurements are only performed on the environment connected to a system. I will show, in particular, that the conditional and unconditional entropy production, which quantify the degree of irreversibility of the open system's dynamics, are related to each other by the Holevo quantity. This, in turn, can be further split into an information gain rate and loss rate, which provide conditions for the existence of informational steady-states, i.e. stationary states of a conditional dynamics that are maintained owing to the unbroken acquisition of information. I will illustrate the applicability of such framework through several examples, including the modelling of a recent experiment in the field of ultracold atoms and cavity optomechanics.