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Maxwell's Demon

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Abstract

"Maxwell's Demon", the famous thought experiment of James Clerk Maxwell, has been devised in 1867 as a counter example for the Second Law of thermodynamics. During the 140 years since the Demon was first suggested, numerous attempts have been made to counter Maxwell's argument. The attempts have been to show that Maxwell was wrong, since his Demon cannot work for one reason or another (see Leff and Rex 2003 for details and references). In this paper we show (following an argument by Albert 2000, Ch. 5.) that Maxwell was basically right, in the sense that his thought experiment is compatible with the laws of mechanics as well as with central principles of statistical mechanics. We then derive some (weak) restrictions on the Demon's efficiency. Finally, we prove that the Demon's cycle of operation can be completed (in particular, the Demon's memory can be erased) without increasing the total entropy of the universe. We draw some conclusions about the way to understand the meaning and role of probability in classical statistical mechanics

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