Von Neumann's Entropy Does Not Correspond to Thermodynamic Entropy

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Abstract

Abstract Von Neumann (1932, Ch. 5) argued by means of a thought experiment involving measurements of spin observables that the quantum mechanical quantity is conceptually equivalent to thermodynamic entropy. We analyze Von Neumann's thought experiment and show that his argument fails. Over the past few years there has been a dispute in the literature regarding the Von Neumann entropy. It turns out that each contribution to this dispute (Shenker 1999, Henderson 2001, Hemmo 2003) addressed a different special case. In this paper we generalize the discussion and examine the full matrix of possibilities that are relevant for the evaluation and understanding of Von Neumann ' s argument.

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