

# Reduction and Renormalization

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## Abstract

This paper discusses the alleged reduction of Thermodynamics to Statistical Mechanics. It includes an historical discussion of J. Willard Gibbs' famous caution concerning the connections between thermodynamic properties and statistical mechanical properties---his so-called "Thermodynamic Analogies." The reasons for Gibbs' caution are reconsidered in light of relatively recent work in statistical physics on the existence of the thermodynamic limit and the explanation of critical behavior using the renormalization group apparatus. A probabilistic understanding of the renormalization group arguments allows for a kind of unification of Gibbs' approach with contemporary understanding of the reduction problem.

**Keywords:** Reduction, Renormalization, Gibbs, Thermodynamics, Statistical Mechanics

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