

# Derivation of Bose-Einstein and Fermi-Dirac statistics from quantum mechanics: Gauge-theoretical structure

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## Abstract

© 2018 IOP Publishing Ltd and SISSA Medialab srl. A possible quantum-mechanical origin of statistical mechanics is discussed, and microcanonical and canonical ensembles of bosons and fermions are derived from the stationary Schrödinger equation in a unified manner. The interaction Hamiltonians are constructed using discrete phase operators and the gauge-theoretical structure associated with them. It is shown how interaction Hamiltonians, stipulated by the gauge symmetry, generate the specific patterns of entanglement desired for establishing microcanonical ensembles. A discussion is also made about the interrelation between random phases and perfect decoherence in the vanishing-interaction limit.

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## Keywords

Gauge symmetry and gauge fields, quantum gases

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