

The Early Interactions of Quantum Statistics, Many-particle Systems, and Quantum Fields

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Abstract:

In 1927 Paul Dirac demonstrated that the quantum-mechanical description of a radiation field could “be made identical with” the formal description of an assembly of particles satisfying the Bose-Einstein statistics. Dirac’s formalism provided Pascual Jordan the means to formulate a quantum field theory of matter, wherein electrons—that is, particles satisfying the Fermi-Dirac statistics—were represented as waves.

At the same time, the integration of quantum statistics with quantum mechanics was opening the way to the quantum-mechanical treatment of many-particle systems, first of all with the formalization of the so-called “exchange interaction” among particles. What was exactly the role of the Bose-Einstein and Fermi-Dirac statistics in these developments? And how did these developments, in turn, reflect upon the understanding of the quantum statistics and of the entities to which they applied?