

Quantum Field Theory

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1 Introduction to Quantum Fields

Quantum Field Theory (QFT) provides a framework for constructing quantum mechanical models of subatomic particles in particle physics and condensed matter physics.

2 Second Quantization

In quantum field theory, second quantization is a standard procedure to quantize fields, where fields themselves are treated as quantum operators.

$$\hat{\psi}(x, t) = \int \frac{d^3p}{(2\pi)^3} \frac{1}{\sqrt{2E_p}} (a_p e^{-ipx} + b_p^\dagger e^{ipx}) \quad (1)$$

3 Feynman Diagrams

Feynman diagrams provide a pictorial representation of the mathematical expressions describing the behavior of subatomic particles.

4 Gauge Theories

Gauge theories form the backbone of the Standard Model, describing how fundamental forces like electromagnetism and the strong and weak nuclear forces operate.