

Introduction to QFT

1 Classical fields

- 1.1 Scalar field $K=G, U(1), Q$
- 1.2 Symmetries and conservation laws: Noether's theorem
- 1.3 Energy-momentum tensor $T_{\mu\nu}, S^{\mu}_{\nu}$

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2 Quantization of a free scalar field

- 2.1 Quantization in QM \hat{a}, \hat{a}^\dagger
- 2.2 Quantization of a real scalar field $\hat{\pi}, \hat{\phi}, \hat{\phi}$
- 2.3 Complex scalar field $\hat{\pi}, \hat{\phi}$

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3 Interactions

- 3.1 Interaction representation $H^I, \langle B \rangle$
- 3.2 Evolution in interaction representation $\theta, T[\], \hat{S}$
- 3.3 Matrix elements of the S-matrix $\langle B_f | S | B_i \rangle$
- 3.4 Calculation of the matrix element $D_F, ::, \Pi$
- 3.5 Disintegration of a massive particle Γ
- 3.6 Scattering and cross section $\sigma, d\sigma$

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4 Free Dirac field

- 4.1 Spinor representation $\psi, S^{\mu\nu}, \Lambda_{1/2}, \gamma_\mu$
- 4.2 Lagrangian of a free Dirac field $\bar{\psi}, \gamma^\mu, L_{Dirac}$
- 4.3 Solution to the free Dirac eq. S_1, u_k, v_k
- 4.4 Quantization
- 4.5 Spin \vec{S}, Σ_i
- 4.6 One-particle states
- 4.7 Statistics

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5 Vector field

- 5.1 Construct a Lagrangian $A_\mu, Proca$
- 5.2 Classical solutions $e_\mu^i(k)$
- 5.3 Canonical quantization

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6 Feynman rules for fermions and vectors

- 6.1 For fermions
- 6.2 Vectors
- 6.3 Decay of a vector into 2 fermions