Quantum Field Theory 2 – Things to Know

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- How is the path integral for quantum mechanics and a scalar quantum field theory derived? What are the pivotal steps?

- What is the generating functional?

- How is Wick's theorem derived in this formulation, and how does one obtain the Feymann rules?

- How are the n-point function obtained from the generating function?

- What is the Schwinger functional?

- How is the Schwinger functional related to the n-point function ?

- What is the definition of the Effective Action?

- What are 1PI diagrams and how are they related to the Effective Action?

- How is the path integral for a fermion theory derived?

- What are Grassmann variables and what are their property ?

- What is a gauge symmetry ?

- What is the Lie-algebra of $SU(N)$?

- What is a Casimir operator and how can it be computed?

- How is the path integral for a gauge theory derived, and why it is necessary to fix the gauge?

- What is the BRST-Symmetry? What is the nilpotentcy of its generator good for?

- What are the implications of the BRST-Symmetry for the n-point function?

- What theories are perturbatively renormalizable ?

- What is the β-function of a coupling and how can it be compute pertubatively?

- What is the β-function of QCD and what is the asymptotic freedom ?

- How can one compute the running coupling from the β-function?

- What is the discrete version of a scalar, fermionic and gauge theory on the lattice?

- How to perform the continuum limit of a lattice gauge theory?

- What is a Wegner-Wilson loop and how it is related to the confinement ?

- How is confinement shown in the strong coupling limit?

- What is the renormalization group? Is it a group or a semi-group?

- What is the Wilson approach to the renormalization group?

- What is a RG Fixed Point and what is its relevance?

- What is a Gaußian, and what is a non-Gaußian fixed point.

- What is the spontaneous symmetry breaking? Does it occur in quantum mechanics?