

1. Relativistic wave functions as field matrix elements between the vacuum and one particle states: discuss their derivation in either the helicity or the spin basis
2. Relativistic wave functions as field matrix elements between the vacuum and one particle states: discuss their properties.
3. The quantization of non-abelian gauge theories
4. Functional methods; discuss some applications like Ward identities, equations of motion or Goldstone Theorem
5. The Kallen-Lehman decomposition
6. Functional methods and perturbation theory in Quantum Field Theory

7. Ultraviolet divergences and renormalization, illustrating how things work beyond one loop

8. Renormalization of composite operators

9. Renormalization: power counting, renormalizable versus non-renormalizable theories

10. The renormalization group, illustrating the variety of flows for renormalizable couplings

11. The Callan-Symanzik equation

12. Multi-field correlators, multi-particle states and the LSZ reduction formula

13. Discuss how unitarity works in quantum gauge theories, possibly with explicit illustrations
14. BRST, physical observables and physical states in quantum gauge theories.
15. Give a synthetic overview of the question of soft photon emission in QED, and present in more detail one aspect of your choice (Ex: Weinberg's soft photon and soft graviton theorems; cancellation of virtual and real emission in inclusive cross section; S-matrix for soft photons treating charged particles as classical sources, ...)