Syllabus for FYS5120 – Advanced Quantum Field Theory, spring 2022

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The syllabus for this self-study course is based on the book *Quantum Field Theory and the Standard Model* by Matthew D. Schwartz (MS) and *An Introduction to Quantum Field Theory* by Michael E. Peskin and Daniel Schroeder (PS). For some topics, I will provide lecture notes (LN). However, you will not need both books to follow the course, but I recommend to use several resources. The topics that we will cover can be found in most standard textbooks on Quantum Field Theory. Other useful books are, *Quantum Field Theory* by Mark Schrednicki, *Quantum Field Theory in a Nutshell* by Anthony Zee, *An Introduction to Quantum Field Theory* by George Sterman, *The Quantum Theory of Fields* by Steven Weinberg.

Chapters in Schwartz

- MS, Ch.14: Path Integral
- MS, Ch.16: Vacuum polarization
- MS, Ch.17: The anomalous magnetic moment
- MS, Ch.18: Mass renormalization
- MS, Ch.19: Renormalized perturbation theory
- MS, Ch.20: Infrared divergences
- MS, Ch.21 and Ch.22.1, 22.2, 22.7: Renormalizability and non-renormalizable theories
- MS, Ch.23: The renormalization group
- MS, Ch.26: Quantum Yang-Mills theory
- MS, Ch.30: Anomalies
- MS, Ch.32: QCD and the parton model

Chapters in Peskin-Schroeder

- PS, Ch.6,7: Radiative Corrections
- Ps, Ch.9: Functional Methods
- PS, Ch.10: Systematics of Renormalization
- PS, Ch.12: The Renormalization Group
- PS, Ch.16: Quantization of Non-Abelian Gauge Theories
- PS, Ch.17: QCD
- PS, Ch.19: Perturbation Theory Anomalies

Note that we may make some small adjustments to the syllabus, so keep an eye on this document.