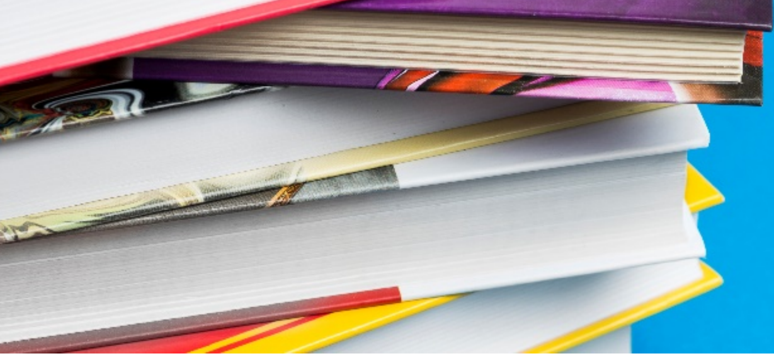

TEL AVIV UNIVERSITY אוניברסיטת תל אביב

סילבוס מפורט

Course title

Lattice Methods in Quantum Field Theory

Lecturer

Prof. Benjamin Svetitsky

Semester

Second semester 5781 (spring 2021)

Prerequisites

Quantum Field Theory 1

Final grade

Term paper

Schedule (elastic)

Lattice gauge theory – Euclidean theory	2-3 weeks
Abelian gauge fields, gauge invariance, Wilson loops, plaquette action	
Non-Abelian gauge fields, action, continuum limit	
Wilson loop in weak and strong coupling, phase diagram at zero temperature	
Matter fields: scalars and “naive” fermions	
Hamiltonian lattice gauge theory	2 weeks
Hamiltonian in temporal gauge, lattice fields, residual gauge invariance	
Strong coupling, static potential, non-Abelian fields, matter fields	
Connection of the Euclidean Wilson loop to the static potential	
Transfer matrix connecting the Hamiltonian to the action	
Duality transformations and phases of spin and gauge systems	3-5 weeks
Ising model, XY model, Abelian gauge theory, monopoles	
Numerical simulations in gauge theories without fermions	2 weeks
Monte Carlo methods, confinement, glueball masses, continuum limit	
Phases at nonzero temperature	
Simulating full QCD	2-3 weeks
Lattice fermions – difficulties in defining the action, and solutions	
Monte Carlo methods for fermions	
QCD particle spectrum	
As time permits:	
Applications such as calculation of scattering amplitudes	
Sum rule for the semester	*13 weeks*

References

J. Kogut, *An Introduction to Lattice Gauge Theory and Spin Systems*, Rev. Mod. Phys. **51**, 659 (1979)

C. Gattringer and C. B. Lang, *Quantum Chromodynamics on the Lattice: an Introductory Presentation* (2010)

H. J. Rothe, *Lattice Gauge Theories* (1992)

T. DeGrand and C. DeTar, *Lattice Methods for Quantum Chromodynamics* (2006)