

# Index

- adjoint representation, 31, 33, 62, 105, 146, 154–7  
Aharonov–Bohm experiment, 33  
anomaly, 21, 26, 76  
anticommuting numbers, 20–8, 148–50  
antiperiodic boundary conditions, 28  
area law, 54–5, 62–7, 82, 140–3  
asymptotic freedom, 6, 88–93, 124, 161  
asymptotic series, 17  
axial gauge, 58
- background field, 91  
bag model, 3  
bare coupling, 17, 29, 81–93, 102, 128  
bare mass, 37, 81, 92, 149  
baryon, 3, 74–6, 149  
Boltzmann weight, 60, 109–15, 127–31, 152  
bond moving, 122–6  
boundary conditions, 10, 28
- Casimir operator, 104–5  
center, group, 146, 155–7, 161  
character expansion, 63, 109, 120, 156  
character orthogonality, 42–3, 50, 109  
charmonium, 1  
chiral symmetry, 21, 26, 27, 54, 75–6, 92, 148  
class function, 109, 152  
condensation, 3, 149  
convexity 96–100  
correlation functions, 11, 36, 128  
correlation length, 53, 81, 87, 144  
Coulomb field, 2, 81  
covariant derivative, 30, 31  
creation and annihilation operators, 23, 68  
critical behavior, 81, 135, 157–61  
critical dimension, 118, 123–5  
critical temperature, 94, 95  
crossover, 139  
current, 21, 76, 92
- decimation, 119–26  
deeply inelastic scattering, 1, 6, 90, 140  
detailed balance, 130  
dimensional transmutation, 86, 88–93, 151  
Dirac string, 155–6
- disconnected diagrams, 65, 71  
doubling, 26, 107  
dual lattice, 111  
duality, 108–16, 126
- eightfold way, 1  
electrodynamics, 5, 30, 108, 118  
electric field, 2, 106  
Elitzur’s theorem, 51, 94  
ensemble, 129–30  
entropy, 97  
equilibrium, 127–39  
Euclidian space, 14
- Faddeev–Popov factor, 59  
fenêtre model, 152, 155  
ferromagnetism, 51–2, 117, 146  
Feynman expansion, 5, 79  
Feynman gauge, 91, 143  
finite size effects, 128  
finite temperature, 145–8  
first order, 53, 99, 118, 135–8, 147, 152, 154, 156, 157, 158  
fixed point, 84–7, 88, 117, 123  
flux tube, 2, 54, 145  
Fock space, 23  
Fourier transform, 14, 15, 25, 26, 112  
free energy, 18, 97–9, 139
- gauge fixing, 36, 56–9, 78, 151  
gauge transformation, 30, 31, 56, 58, 106  
Gaussian model, 14  
Gauss’s law, 2, 106  
generating function, 16, 70  
generating state, 69–70  
global symmetry, 51, 146  
glueball, 53, 82, 144–5, 147  
Goldstone boson, 27, 54, 56, 76, 149  
grand unification, 4, 93  
Green’s functions, 16, 18, 68, 71, 101  
ground state, 11
- Hamiltonian, 8–13, 26, 58, 101–7  
heat bath, 128–34  
heat kernel action, 152–3  
heavy ion collisions, 147

- Heisenberg representation, 11  
 Higgs mechanism, 37, 56  
 high temperature expansion, 6, 60–76  
 Hilbert space, 8, 10, 102–3  
 hopping constant, 19, 28, 74  
 hysteresis, 137–8
- imaginary time, 8, 11  
 indefinite metric, 33  
 initial conditions, 128, 134–7  
 inner product, 10, 103  
 internal energy, 52, 138  
 internal symmetry, 3, 29, 54, 68, 71, 148  
 invariant measure, 36, 39–50, 131  
 Ising model, 94–8, 108–9, 118–23, 152, 156  
 isospin, 1, 29
- Jacobian, 40
- kinetic energy, 102
- Laplacian, group, 153  
 left hand rule, 111  
 left invariance, 39, 41  
 linear potential, 2, 54–5, 140, 152  
 local symmetry, 30, 37, 151
- magnetic field, 2, 105–6  
 magnetization, 51–2, 95, 146, 155  
 Manton action, 152–3  
 Markov chain, 129  
 mass gap, 53–4, 56, 67, 76, 87, 144–5, 147  
 maximal tree, 58, 112  
 Maxwell's equations, 30  
 measure, group, 36, 39–50, 131  
 Meissner effect, 2  
 metastable state, 128, 135, 139  
 metric, 14, 33  
 metric, group, 41, 152–3  
 Metropolis algorithm, 131–6, 148  
 momentum space, 16, 17, 143  
 monopole, 2, 155–6
- order parameter, 51–6, 146
- partition function, 6, 8, 77, 155  
 path integral, 6, 8–13, 127, 151  
 path ordering, 31–4  
 Pauli matrices, 21, 29, 133  
 perimeter law, 55  
 periodic boundary conditions, 10, 14  
 perturbation expansion, 17, 79  
 photon phase, 115, 118  
 pion, 54, 76, 92, 148, 149  
 pion–nucleon coupling, 92  
 planar model, 118
- potential energy, 97, 102  
 Potts model, 115, 147  
 projection operator, 27  
 propagator, 12, 17, 22, 25, 79, 149
- quantum statistical mechanics, 12, 145
- random numbers, 132  
 random walk, 132, 149  
 Regge trajectories, 1, 144, 149, 150  
 renormalization group, 5, 81–93, 108, 117–26, 140, 145, 147, 149, 160  
 renormalization scale, 89–91, 106, 144, 160  
 renormalized coupling, 89–90, 118, 140  
 right invariance, 41
- scheme dependence, 87, 88, 91, 106, 143  
 screening, 55, 146–7  
 second order, 81, 137, 156  
 self energy, 55, 146, 158  
 sources, 16, 22, 68  
 specific heat, 139, 157  
 spin chain, 58, 117, 125  
 spin waves, 77, 117  
 staircase construction, 83–7  
 string bit, 69–70  
 string model, 1, 73–5, 144  
 string space, 69  
 string tension, 62–7, 87, 141–5, 147, 150, 153  
 strong coupling expansion, 18, 37, 60–76  
 supercooling and superheating, 135–8
- temporal gauge, 56–9, 78, 101–7  
 thermal cycle, 137–8, 154  
 thermal equilibrium, 127–39  
 thermal fluctuations, 135, 144, 147  
 three point vertex, 75, 76, 89, 91, 143  
 time-independent gauge transformations, 56, 58, 106  
 time ordering, 11–12  
 topological expansion, 74  
 transfer matrix, 8–13, 25, 58, 101–7, 119, 152–3  
 tree, 58, 59, 112  
 triple point, 157  
 type II superconductor, 2
- ultraviolet attractive, 85–7, 88  
 universality, 151  
 upsilon particle, 1
- vacuum, 11  
 vacuum fluctuations, 71  
 valence quarks, 149–50  
 variational method, 144  
 vector potential, 29, 33, 34

- vertices, 17, 75, 79, 82  
Villain action, 114–15, 152–3  
virial theorem, 13  
virtual quark loops, 149  
Wilson line, 146–7  
Wilson loop, 32, 54–5, 60–7, 140–3  
Yang–Mills theory, 29, 34, 37, 151  
Yukawa law, 53, 144





