

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

 Fadeev–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
 epsilon particle, 1

 vacuum, 11
 vacuum fluctuations, 71
 valence quarks, 149–50
 variational method, 144
 vector potential, 29, 33, 34

Index

169

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