

Bibliography

In the bibliography we cite only books and, as far as possible, recent review articles in which more details and references can be found. Unfortunately, with such a choice of references many important works are missing in our list which in no way claims to be complete.

On Gauge Field Theories in General

- Abers, E. S., Lee, B. W.: Gauge Theories. Phys. Rep. **9**, 1 (1973)
Becher, P., Böhm, M., Joos, H.: *Eichtheorien der starken und elektroschwachen Wechselwirkung* (Teubner, Stuttgart 1983)
Faddeev, L. D., Slavnov, A. A.: *Gauge Fields: Introduction to Quantum Field Theory* (Benjamin/Cummings, Reading, MA 1980)
Itzykson, C., Zuber, J.-B.: *Quantum Field Theory* (McGraw-Hill, New York 1980)
Okun, L. B.: *Leptons and Quarks* (North-Holland, Amsterdam 1981)
Taylor, J. C.: *Gauge Theories of Weak Interactions* (Cambridge Univ. Press, Cambridge 1976)
Zinn-Justin, J.: *Trends in Elementary Particle Theory*, ed. by H. Rollnik, K. Dietz (Springer, Berlin, Heidelberg, New York 1975)

Part I. Invariant Lagrangians

Quantum Field Theory

- Bjorken, T. D., Drell, S. D.: *Relativistic Quantum Field Theory* (McGraw-Hill, New York 1964)
Bogoliubov, N. N., Shirkov, D. V.: *Introduction to the Theory of Quantized Field* (Wiley, New York 1980)
Itzykson, C., Zuber, J.-B.: *Quantum Field Theory* (McGraw-Hill, New York 1980)
Pauli, W.: Relativistic field theory of elementary particles. Rev. Mod. Phys. **13**, 203 (1941)
Ramond, P.: *Field Theory. A Modern Primer* (Benjamin/Cummings, Reading, MA 1981)
Schweber, S. S.: *An Introduction to Relativistic Quantum Field Theory* (Row, Peterson and Co., New York 1962)
Wentzel, G.: *Quantum Theory of Fields* (Interscience, New York 1949)

Elementary Particle Physics

- Aitchison, I. J. R., Hey, A. J. G.: *Gauge Theories in Particle Physics. A Practical Introduction* (Adam Hilger, Bristol 1982)
Gasiorowicz, S.: *Elementary Particle Physics* (Wiley, New York 1966)
Källén, G.: *Elementary Particle Physics* (Addison-Wesley, Reading, MA 1964)
Lee, T. D.: *Particle Physics and Introduction to Field Theory* (Harwood, Chur 1981)
Nelipa, N. F.: *Physique des Particules Élémentaires* (Edition MIR, Moscow 1981)
Nishijima, K.: *Fields and Particles* (Benjamin, New York 1969)

Group Theory. Unitary Symmetry

- Carruthers, P.: *Introduction to Unitary Symmetry* (Interscience, New York 1966)
Gel'fand, I. M., Minlos, R. A., Shapiro, Z. Ya.: *Representation of the Rotation Group and of the Lorentz Group and Their Applications* (MacMillan, New York 1963)
Lipkin, H. J.: *Lie Groups for Pedestrians* (North-Holland, Amsterdam 1965)

- Slansky, R.: Group theory for unified model building. Phys. Rep. **79C**, 1 (1981)
 Zhelobenko, D. P.: Compact Lie groups and their applications. Am. Math. transl. **40** (1973)

Spontaneous Symmetry Breaking

- Bernstein, J.: Spontaneous symmetry breaking, gauge theories, the Higgs mechanism and all that. Rev. Mod. Phys. **46**, 7 (1974)
 Coleman, S.: "Secret Symmetry": *Laws of Hadronic Matter*, Proc. of the 11th Course of the "Ettore Majorana", Intern. School of Subnuclear Physics, ed. by A. Zichichi (Academic, New York 1975)

Part II. Quantum Theory of Gauge Fields

Path Integrals and Covariant Perturbation Theory

- Berezin, F. A.: *Methods of Second Quantization* (Academic, New York 1966)
 Dirac, P. A. M.: *Lectures on Quantum Mechanics* (Yeshiva University, New York 1964)
 Faddeev, L. D.: "Introduction to Functional Methods", in *Methods in Field Theory*, Les Houches Summer School 1975, ed. by R. Balian, J. Zinn-Justin (North-Holland, Amsterdam 1976)
 Feynman, R. P., Hibbs, A. R.: *Quantum Mechanics and Path Integrals* (McGraw-Hill, New York 1965)
 Klauder, J. R.: "Path Integral" in *Field and Strong Interactions*, Proc. XIX Intern. Universitätswochen für Kernphysik, Schladming, 1980, ed. by P. Urban (Springer, Wien, New York 1980) p. 3

Part III. Gauge Theory of Electroweak Interactions

Electromagnetic and Weak Interactions

- Akhiezer, A. I., Berestetski, V. B.: *Quantum Electrodynamics* (Interscience, New York 1965)
 Berestetski, V. B., Lifshitz, E. M., Pitayevski, L. P.: *Relativistic Quantum Theory*, Part I (Pergamon, London 1971)
 Commins, E. D.: *Weak Interactions* (McGraw-Hill, New York 1973)
 Feynman, R. P.: *Quantum Electrodynamics* (Benjamin, New York 1961)
 Lifshitz, E. M., Pitayevski, L. P.: *Relativistic Quantum Theory*, Part II (Pergamon, London 1972)
 Okun, L. B.: *Leptons and Quarks* (North-Holland, Amsterdam 1981)
 Taylor, J. C.: *Gauge Theories of Weak Interactions* (Cambridge University Press, Cambridge 1976)

Leptons, Quarks. Quark Model

- Close, F. E.: *An Introduction to Quarks and Partons* (Academic, London 1979)
 Greenberg, O. W., Nelson, C. A.: Colour models of hadrons. Phys. Rep. **32C**, 69 (1977)
 Huang, K.: *Quarks, Leptons and Gauge Fields* (World Scientific, Singapore 1983)
 Kalmus, G.: "Weak Decays of New Particles", in Proc. 21 Intern. Conf. on High Energy Physics, Paris 1982, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982), p. 431
 Kokkedee, J.: *The Quark Model* (Benjamin, New York 1969)
 Maiani, L.: *Theoretical Ideas on Heavy Flavor Weak Decays*, in Proc. 21 Intern. Conf. on High Energy Physics, Paris 1982, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982), p. 631
 Trilling, G. H.: The properties of charmed particles. Phys. Rep. **75C**, 57 (1981)

Standard Model. Neutral Currents

- Beg, M. A. B., Sirlin, A.: Gauge theories of weak interaction. Phys. Rep. **88C**, 1 (1982)
 Dalitz, R. M.: "CP-Nonconservation", in *Electroweak Interactions*, Proc. XXI Intern. Universitätswochen für Kernphysik, Schladming 1982, ed. by H. Mitter (Springer, Wien, New York 1982) p. 393

- Davier, M.: "Electroweak Neutral Current", in Proc. 21 Intern. Conf. on High Energy Physics, ed. by P. Petiau, M. Porneuf (Les Editions de Physique, Paris 1982) p. 471
- Ecker, G.: "Introduction to Gauge Theories of Electroweak Interactions", in *Electroweak Interactions*, Proc. XXI Intern. Universitätswochen für Kernphysik, Schladming 1982, ed. by H. Mitter (Springer, Wien, New York 1982) p. 3
- Fritzsch, H., Minkowski, P.: Flavordynamics of quarks and leptons. Phys. Rep. **73C**, 67 (1981)
- Harari, H.: Quarks and leptons. Phys. Rep. **42C**, 235 (1978)
- Kim, J. E., Langacker, P., Levine, M., Williams, H. H.: A theoretical and experimental review of the weak neutral current. Rev. Mod. Phys. **53**, 211 (1981)

Renormalization

- Faddeev, L. D., Slavnov, A. A.: *Gauge Fields: Introduction to Quantum Theory* (Benjamin/Cummings, Reading, MA 1980)
- Fradkin, E. S., Tyutin, I. V.: Renormalizable theory of massive vector particles. Riv. Nuovo Cim. **4**, 1 (1974)
- Leibbrandt, G.: Introduction to the technique of dimensional regularization. Rev. Mod. Phys. **47**, 849 (1975)
- Narison, S.: Techniques of dimensional regularization and the two-point functions of QCD and QED. Phys. Rep. **84C**, 263 (1982)
- Zinn-Justin, J.: "Renormalization of Gauge Theories", in *Trends in Elementary Particle Theory*, Lecture Notes Phys. Vol. 37, ed. by H. Rollnik, K. Dietz (Springer, Berlin, Heidelberg, New York 1975) p. 2

Part IV. Gauge Theory of Strong Interactions

Strong Interactions

- de Alfaro, V., Fubini, S., Furlan, G., Rossetti, C.: *Currents in Hadron Physics* (North-Holland, Amsterdam 1973)
- Collins, P. D. B., Squires, E. J.: *Regge Poles in Particle Physics*. Springer Tracts Mod. Phys., Vol. 45 (Springer, Berlin, Heidelberg, New York 1968)
- Eden, R. J., Landshoff, P. V., Olive, D. I., Polkinghorne, J. C.: *The Analytic S-Matrix* (Cambridge University Press, Cambridge 1966)
- Nelipa, N. F.: *Physique des Particules Élémentaires* (Edition MIR, Moscow 1981)

Asymptotic Freedom

- Politzer, H. D.: Asymptotic freedom: an approach to strong interactions. Phys. Rep. **14C**, 129 (1974)

Perturbative Quantum Chromodynamics. Hard Processes

- Altarelli, G.: Partons in QCD. Phys. Rep. **81C**, 1 (1982)
- Buras, A. J.: Asymptotic freedom in deep inelastic processes in the leading order and beyond. Rev. Mod. Phys. **52**, 199 (1980);
"A Tour of Perturbative QCD", in Proc. Int. Symp. on Lepton and Photon Interactions at High Energies, ed. by W. Pfeil (Bonn University, Bonn 1981) p. 636
- Dokshitzer, Y. L., Dyakonov, D. I., Troyan, S. I.: Hard processes in QCD. Phys. Rep. **58C**, 269 (1980)
- Feynman, R. P.: *Photon-Hadron Interactions* (Benjamin, New York 1972)
- 't Hooft, G.: How well do we understand QCD? Status report of a theory, Proc. Intern. Conf. on High Energy Physics, ed. by J. Dias de Deus, J. Soffer (Lisbon 1981) p. 641
- Marciano, W., Pagels, H.: Quantum chromodynamics. Phys. Rep. **36C**, 137 (1978)
- Nachtmann, O.: "The Classical Tests of Quantum Chromodynamics", in *Field Theory and Strong Interactions*, Proc. of the XIX Intern. Universitätswochen für Kernphysik, Schladming 1980, ed. by P. Urban (Springer, Wien, New York 1980) p.101

- Petermann, A.: Renormalization group and the deep structure of the proton. *Phys. Rep.* **53C**, 157 (1979)
- Reya, E.: Perturbative quantum chromodynamics. *Phys. Rep.* **69C**, 195 (1981)
- Walsh, T. F.: "Phenomenology of Jets", in *Field Theory and Strong Interactions*, Proc. XIX Intern. Universitätswochen für Kernphysik, Schladming 1980, ed. by P. Urban (Springer, Wien, New York 1980) p. 439
- Ynduráin, F. J.: *Quantum Chromodynamics* (Springer, Berlin, Heidelberg, New York, Tokyo 1983)

Lattice Gauge Theories

- Hasenfratz, P.: "Lattice Gauge Theories", Proc. Intern. Conf. on High Energy Physics, ed. by J. Dias de Deus, J. Soffer (Lisbon 1981) p. 619
- Kogut, J. B.: The lattice gauge theory approach to quantum chromodynamics. *Rev. Mod. Phys.* **55**, 775 (1983)
- Wilson, K. G.: Quark on a lattice, or, the coloured string model. *Phys. Rep.* **23C**, 331 (1976)
- Wilson, K. G.: "Quantum chromodynamics on a lattice", in *New Developments in Quantum Field Theory and Statistical Mechanics*, ed. by M. Levy, P. Mitter (Plenum, New York 1977) p. 143

Grand Unification

- Ellis, J.: "Phenomenology of Unified Gauge Theories", in *Gauge Theories in High Energy Physics*, Les Houches Summer School Proc. 37, ed. by M. K. Gaillard, R. Stora (North-Holland, Amsterdam 1983) p. 155
- Georgi, H.: "Grand Unification", in Proc. 21 Intern. Conf. on High Energy Physics, Paris 1982, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982) p. 705
- Langacker, P.: Grand unified theories and proton decay. *Phys. Rep.* **72C**, 185 (1981)
- Ramond, P. (ed.): *Grand Unified Theories and Related Topics* (World Scientific, Singapore 1981)
- Salam, A.: Gauge unification of fundamental forces. *Rev. Mod. Phys.* **52**, 525 (1980)
- Zee, A.: Unity of Forces in the Universe, Vol. 1 (World Scientific, Singapore 1982)

Solitons, Instantons

- Faddeev, L. D., Korepin, V. E.: Quantum theory of solitons. *Phys. Rep.* **42C**, 1 (1978)
- Marciano, W., Pagels, H.: Quantum chromodynamics. *Phys. Rep.* **36C**, Chap. 3 (1978)
- Olive, D., Saito, S., Crewther, R. J.: Instanton in field theory. *Riv. Nuovo Cim.* **2**, No. 8 (1979)
- Olive, D.: Magnetic monopoles. *Phys. Rep.* **49C**, 165 (1979)
- Rajaraman, R.: *Solitons and Instantons* (North-Holland, Amsterdam 1982)
- Rossi, P.: Exact results in the theory of non-abelian magnetic monopoles. *Phys. Rep.* **86C**, 317 (1982)

Conclusion

Bag and String Model

- Gervais, J. L., Jacob, M. (ed.): *Non-linear and Collective Phenomena in Quantum Physics* (World Scientific, Singapore 1983)
- Hasenfratz, P., Kuti, J.: The quark bag model. *Phys. Rep.* **40C**, 76 (1978)
- Jaffe, R. L.: "Application of the Bag Model", in *Field Theory and Strong Interactions*, Proc. XIX Intern. Universitätswochen für Kernphysik, Schladming 1980, ed. by P. Urban (Springer, Wien, New York 1980) p. 269
- Neveu, A.: "Revival of the String Model", in Proc. 21 Intern. Conf. on High Energy Physics, Paris 1982, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982) p. 260

Potential Models

- Chaichian, M., Kögerler, R.: Coupling constants and the nonrelativistic quark model with charmonium potential. *Ann. Physics (New York)* **124**, 61 (1980)

Gottfried, K.: "Hadronic spectroscopy", in *Proc. Intern. Europhysics Conf. on High Energy Physics*, Brighton 1983, ed. by J. Guy, C. Costain (Rutherford Appleton Laboratory, Chilton, Didcot 1983) p. 743

QCD Sum Rules

- Novikov, V. A., Okun, L. B., Shifman, M. A., Vainshtein, A. I., Voloshin, M. B., Zakharov, V. I.: Charmonium and gluons. *Phys. Rep.* **41C**, 1 (1978)
- de Rafael, E.: Current algebra quark masses in QCD, *Proc. of NSF-CNRS Joint Seminar on Theoretical Aspects of Quantum Chromodynamics*, ed. by J. W. Dash, CPT-81-Pub. 1345 (Marseille, 1981) p. 259
- Rubinstein, H. R.: "Non-Perturbative Effects and QCD Sum Rules", *Proc. 21 Intern. Conf. on High Energy Physics*, Paris 1982, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982) p. 249
- Shifman, M. A.: "Theory of Heavy Quark-Antiquark States", *Proc. Intern. Symp. on Lepton and Photon Interactions at High Energies*, ed. by W. Pfeil (Bonn University, Bonn 1981) p. 242

Theory of Loop Functionals

Migdal, A. A.: "Loop Dynamics", *Intern. Conf. on High Energy Physics*, ed. by J. Dias de Deus, J. Soffer (Lisbon, 1981) p. 581

Technicolour

- Farhi, E., Jackiw, R. (eds.): *Dynamical Gauge Symmetry Breaking* (World Scientific, Singapore 1982)
- Farhi, E., Susskind, L.: Technicolour. *Phys. Rep.* **74C**, 277 (1981)

Supersymmetric Unified Models

- Barbieri, R.: "Supersymmetric Gauge Models of the Fundamental Interactions", in *Electroweak Interactions*, *Proc. XXI Intern. Universitätswochen für Kernphysik, Schladming 1982*, ed. by H. Mitter (Springer, Wien, New York 1982) p. 363
- Fayet, P.: "Unified Models of Particles and Interactions", *Proc. 21 Intern. Conf. on High Energy Physics*, ed. by P. Petian, M. Porneuf (Les Editions de Physique, Paris 1982) p. 673
- Fayet, P., Ferrara, S.: Supersymmetry. *Phys. Rep.* **32C**, 251 (1977)
- Nanopoulos, D.: "Grand Unified Models and Physical Supersymmetries", in *SU(3) × SU(2) × U(1) and Beyond*, *Proc. XIII GIFT Intern. Seminar on Theor. Phys.*, Masella, Spain 1982, ed. by A. Ferrando, J. A. Grifols, A. Mendez (World Scientific, Singapore 1983)
- Zumino, B.: "New Developments in Grand Unified Theories", *Proc. Intern. Conf. on High Energy Physics*, ed. by J. Dias de Deus, J. Soffer (Lisbon, 1981) p. 601

Supergravity

van Nieuwenhuizen, P.: Supergravity. *Phys. Rep.* **68C**, 189 (1981)

Superunification

Ellis, J.: "GUTs, Astrophysics and Superunification", *Proc. Intern. Conf. Neutrino '82*, Vol. I, ed. by A. Frenkel, L. Jenik (KFKI, Budapest 1982) p. 304

Composite Models

't Hooft, G.: "Naturalness, Chiral Symmetry and Spontaneous Chiral Symmetry Breaking", in *Recent Developments in Gauge Theories*, ed. by G. 't Hooft, C. Itzykson, A. Jaffe, H. Lehmann, P. K. Mitter, I. Singer (Plenum, New York 1980) p. 135

- 't Hooft, G.: "Theoretical Perspectives", in Proc. 21 Intern. Conf. on High Energy Physics, Paris 1982, ed. by P. Petiau, M. Porneuf (Les Editions de Physique, Paris 1982) p. 755
- Peccei, R. D.: "Composite Models of Quarks and Leptons", in *Gauge Theories of the Eighties*, Lecture Notes Phys., Vol. 181, ed. by R. Raitio, J. Lindfors (Springer, Berlin, Heidelberg, New York, Tokyo 1983) p. 355
- Peskin, M. E.: "Compositeness of Quarks and Leptons", in Proc. Int. Symp. on Lepton and Photon Interactions at High Energies, ed. by W. Pfeil (Bonn University, Bonn 1981) p. 880

Elementary Particles and Cosmology

- Dolgov, A. D., Zeldovich, Ya. B.: Cosmology and elementary particles. *Rev. Mod. Phys.* **53**, 1 (1981)

List of Symbols

Fields

in the general case	$u_i(x)$
scalar field	$\phi(x)$
spinor field	$\psi(x), \bar{\psi}(x) = \psi^\dagger(x) \gamma_0$
electromagnetic field	$A_\mu(x)$
non-Abelian gauge field	$A_\mu^k(x)$
ghost field	$c^k(x), \bar{c}^k(x)$
gluon field	$V_\mu^m(x)$

Electromagnetic field tensor $F_{\mu\nu}(x)$

Non-Abelian gauge field tensor $F_{\mu\nu}^k(x)$

Lagrangian

globally invariant	$L(x)$
locally invariant	$\mathcal{L}(x)$

Action $I(u_i)$

Transition amplitude S

Derivative

ordinary	∂_μ
covariant	∇_μ

Path integral $\int \mathcal{D}u_i(x)$

Transformation parameters

global	ε_k
local	$\varepsilon_k(x)$

Element of the gauge group $\omega(x)$

Structure constants f_{abc}

Generators of transformations

in the general case	T_{ab}^k
for the fermions $\psi^a(x)$	$(t_k)_{ab}$
for the scalars $\phi^a(x)$	$(\theta_k)_{ab}$

Generating functionals for the Green's functions

complete	$W(J_i)$
connected	$Z(J_i)$
one-particle-irreducible	$\Gamma(\Phi_i)$

Propagators

(the capital italic letters refer to the full propagators and the script letters to the propagators in the tree approximation)

for photons	$D_{\mu\nu}(x-y), \mathcal{D}_{\mu\nu}(x-y)$
for non-Abelian gauge fields	$D_{\mu\nu}^{kl}(x-y), \mathcal{D}_{\mu\nu}^{kl}(x-y)$
for scalar fields	$D^{ab}(x-y), \mathcal{D}^{ab}(x-y)$
for spinor fields	$G^{ab}(x-y), \mathcal{G}^{ab}(x-y)$

Left-handed spinor doublets of particles $L^a(x)$

Right-handed spinor singlets $R(x)$

Currents

electromagnetic	$J_\mu(x)$
neutral weak	$J_\mu^n(x)$
charged weak	$J_\mu^{(\pm)}(x)$

Structure functions $W_i(x, q^2)$

Subject Index

- Altarelli-Parisi equations 239
- Amplitude 18
- Anomalies 182
- Anticommuting variables 62
- Area law 238
- Asymptotic freedom 192
- Asymptotic region 187

- Bag model 316
- Beauty (bottom) 125
- Becchi-Rouet-Stora transformation 177
- Bjorken scaling 210

- Cabibbo angle 155
- Charge quantization 268
- Charm 120
- Chronological ordering 17
- Chronological product 79
- Closed loop 248
- Colour 122
- Composite models 320
- Consistency conditions 64
- Constraints 63
 - primary 65
 - secondary 65
- Correlation functions 263
- Covariant derivative 29
- CP violation 160–165
- Critical point 42
- Currents
 - charged weak, leptons 115
 - charged weak, quarks 126
 - electromagnetic, leptons 114
 - electromagnetic, quarks 126
 - neutral weak, charged leptons 115
 - neutral weak, neutrino 115
 - neutral weak, quarks 127

- Deep inelastic
 - region 208
 - scattering 208
- Diagrams
 - connected 83
 - disconnected 82
 - one-particle-irreducible 83
- Dimension
 - representation 12
 - sphere 297
- Dimensional regularization 171
- Dirac matrices 11
- Distribution functions
 - gluons 218
 - partons 212
 - quarks 217
- Divergence index 168
- Divergences 167
- Dyonic solution 306

- Early scaling 263
- Effective (or running)
 - coupling constant 191, 230
 - mass 191
- Effective Lagrangian 128
- Equilibrium state 261
- Evolution equation 239
- 1/ N -expansion 101

- Faddeev-Popov ghost 77
- Faddeev-Popov trick 75
- Feynman diagrams 19
- Field
 - gauge 27, 74
 - matter 29
 - operator 16
 - scalar 11
 - spinor 12
 - tensor 11
 - vector 11
- Fixed points 192
- Flavour 122

- Gauge condition 72
 - axial 74
 - Coulomb 72
 - Feynman 97
 - α -gauge 78
 - Hamilton 72
 - Landau 97
 - Lorentz 72

- Gauge fields
 - Abelian 34
 - massive 38
 - massless 38
 - non-Abelian 35
 - self-interaction 37
- Generalized Ward identities 174
- Generating functional
 - $W(J)$ 81
 - $Z(J)$ 83
 - $\Gamma(\Phi)$ 84
- Generators
 - group 9
 - representation 10
- Gluon 220
- Gluon effects in quantum chromodynamics 232–241
- Goldstone boson 32
- Grand unification 266
- Green's function 79
 - complete 83
 - connected 83
 - one-particle-irreducible 83
- Gribov multi-valuedness, or ambiguity 73
- Group 8
 - Abelian 9
 - classification 25
 - colour 220
 - dimension 8
 - gauge 26
 - global 7
 - homotopy 297
 - Lie 9
 - local 26
 - Lorentz 8
 - non-Abelian 9
 - Poincaré 8
 - structure constants 24
 - unitary 19
- Hadron
 - fragmentation 243
 - structure 207
- Hamiltonian formalism 15
- Hard process 225
- Higgs
 - boson 45
 - mechanism 45
- Homotopic mapping 296
- Homotopy
 - class 296
 - group 297
- Hopping parameter 252
- Instantons 306
- Integration measure 57
- Interaction
 - long-range 38
 - short-range 38
- Interaction vertices 92
- Intermediate bosons 116, 271
- Internal
 - properties 19
 - transformation 19
- Isotopic properties 20
- Jacobian of the mapping 307
- Kink 291
- Kobayashi-Maskawa matrix 155
- Kronecker index 305
- Lagrangian
 - effective 116
 - formalism 14
 - full (total) 15, 33
 - gauge field 32
 - global invariance conditions 25
 - globally invariant 26
 - interaction 14
 - local invariance condition 28
 - locally invariant 26
 - quantum chromodynamics 222
 - quantum electrodynamics 35
 - standard model 113
 - total (full) 15, 33
- Lattice
 - gauge theory 245–250
 - quantum chromodynamics 254
 - theory for fermions 250–254
- Leading logarithmic approximation 241
- Lie algebra 9
- Link 246
- Loop average 256
- Matrices
 - Dirac 11
 - Gell-Mann 22
 - Kobayashi-Maskawa 155
 - Pauli 21
- Matrix element 18
- Mixing angle 48
- Monopole 303
- Monte-Carlo method 260
- Multiplets
 - charmed 118
 - isotopic 118
 - unitary 118
- Multiplicative renormalization 188

- Neutral weak current 115
- Non-renormalizable theory 170
- Non-standard models 129
- Normal dimension 190

- Operator form of quantum field theory 19
- Orbits 66
- Ordered
 - loop product 248
 - matrix product 247
- Orientation of link 248

- Parameters of mixing 153
- Parton model 211
- Path integral 56
- Path integral form of the transition amplitude
 - boson fields 60
 - electromagnetic field 70
 - gauge fields 74
 - over all fields 60
 - fermion fields 61
- Pati-Salam model 287
- Perturbation theory
 - chromodynamics 220
 - electrodynamics 133, 17
 - ϕ^4 -interaction 89
 - model with non-Abelian fields 94
 - solitons 309
- Plaquette 246
- Points
 - stable 193
 - unstable 193
- Pontrjagin number 307
- Potential models 317
- Principle of least action 15
- Propagator 80
- Proton
 - decay 273
 - lifetime 274

- Quantum chromodynamics 220
- Quantum electrodynamics 133
- Quark
 - b (beauty or bottom) 125
 - characteristics 119
 - colour 122
 - confinement 185, 259
 - generations 268
 - heavy 125
 - lepton symmetry 123
 - mixing 153
 - model 118
 - sea 213
 - t (top) 125
 - valence 213

- Rank of group 10
- Regularization 171
- Relativistically invariant quantities 13
- Renormalization
 - group 189
 - group equation 190
- Renormalization procedure 170
- Renormalizable theory 170
- Representation of group 11
 - adjoint 12
 - fundamental 12
 - irreducible 13
 - reducible 13
- Residual symmetry 49
- R -operation 173
- Running
 - charge 191, 230
 - coupling constant 230
 - mass 191

- Sample state 261
- Sampling 261
- Scaling
 - exact 210
 - violation 210
- Self-consistency condition 64
- Site 246
- Sine-Gordon model 292
- Slavnov-Taylor identities 174
- S -matrix 17
- Solitons 289
- Spontaneous breaking of
 - global symmetry 39
 - local symmetry 43
- Stable fixed point 193
- Stationary phase method 103
- String tension 259
- Strong coupling expansion 256
- Structure constants 24
- Structure functions 208
- Structure of SU_n -multiplets 275 – 278
- Subsidiary conditions 66
- Sum rules
 - parton model 213
 - QCD 325
- Supergravity 319
- Supersymmetric unified models 319
- Superunification 319
- Symmetry
 - dynamically broken 319
 - exact 39
 - internal 7

Symmetry (cont.)

- space-time 7
- spontaneously broken 39
- U_1 20, 34
- SU_2 20, 35
- SU_3 22, 220
- SU_5 267
- SU_8 284
- SU_n 275

Technicolour 319

Time-ordered product 17

Topological charge 300

Transition amplitude 18

Tree approximation 86

Unstable fixed point 193

Vacuum

- degenerate 38
 - expectation value 40
 - invariant 38
 - minimal value 38
 - non-degenerate 38
 - state 16
- Vortex 294

Weak

charged currents 115, 126

Neutral currents 115, 126

Weinberg angle 117

Wilson criterion for quark confinement 259

Wilson operator expansion 234

Zero-mode 312