Index

Abramovsky–Gribov–Kancheli (AGK) cutting rules, 269, 270
aligned-jet model, 258, 259
anomalous dimension
  BFKL equation, 95, 96, 174, 179, 180, 237, 239, 245–247
  DGLAP equation, 61, 62, 95, 245–248
asymptotic freedom, 1, 19, 21
atomic number, 130, 136, 141, 199, 235, 238, 270
Ayala–Gay-Ducati–Levin (AGL) equation, 120

Babinet's principle, 107, 254
Balitsky hierarchy, 224, 225
Balitsky–Kovchegov (BK) equation, 123, 163, 169–175, 178, 183–185, 187–189, 197, 224, 225, 228–232, 240, 244, 248, 257, 264, 265, 268, 269, 271, 285, 291, 303–306
  numerical solution, 184, 185, 187, 236
  semiclassical solution, 178–180
  solution, 172, 176–178
    inside the saturation region, 176, 177
    outside the saturation region, 172–176
  traveling wave solution, 181–183
Balitsky–Fadin–Kuraev–Lipatov (BFKL) equation, 74, 82, 92, 93, 95, 102, 132, 153–155, 158, 170, 172, 185, 187, 189, 190, 225, 228, 229, 232, 240, 248, 270, 303, 305, 306
  bootstrap property, 103, 105–107, 235, 248
  eigenfunctions, 95–98, 157–160, 162, 194, 195
  eigenvalues, 95–98, 157, 158, 194, 195
  Green function, 93, 97–99, 101, 110, 122, 130, 245, 246, 273
    nonforward, 104–107
  in coordinate space, 153, 156, 157, 192, 194, 287, 303
    solution, 157–160, 162, 195
  infrared problem, 107, 110, 111, 187, 188
  renormalization-group-improved kernel, 245–247
  solution, 95–99, 101, 102
    diffusion approximation, 98
    double logarithmic approximation, 99
  unitarity problem, 74, 107, 109, 110, 112, 113, 115, 185
Bartels cigar, 111, 187
Bartels–Kwiecinski–Praszalowicz (BKP) equation, 123, 189, 190, 196
BFKL pomeron, 99, 117, 121, 122, 191, 192, 228, 243–245, 248, 249, 270, 304, 305
  intercept, 99, 228, 238, 243, 247–249
Bjorken frame, 27, 40–42, 113, 118
Bjorken scaling, 29, 35, 44, 63
black-disk limit (BDL), 107–109, 141, 172, 176, 185, 187, 253, 254, 258, 303, 304, 318
bootstrap equation, 106, 107
Borel resummation, 241, 249
Breit frame, 41, 42, 113, 118
Brodsky–Lepage–Mackenzie (BLM) prescription, 229, 230

Callan–Gross relation, 35, 63, 127
Catani–Ciafaloni–Fiorani–Marchesini (CCFM) equation, 245, 306
classical approximation, 203–205, 214, 275, 280, 282, 283, 290
classical equations of motion, 200, 204, 275
classical gluon field, 198, 200, 203–205, 207, 210, 214, 216, 275, 290
coefficient function, 37
color charge density, 199–202, 205, 213, 215–217, 226
color glass condensate (CGC), 189, 215, 216, 224, 226, 249, 256, 270, 271, 284, 291, 293, 301, 304–306
color transparency, 141, 172
confinement, in QCD, 1, 21, 201, 304, 312
confinement scale, 30, 112
correlation function, 116, 292, 296, 301, 303, 305
covariant gauge, *see* Feynman gauge
critical trajectory, 179–181, 237
Cronin effect, 284, 289
crossing symmetry, 56, 313
Cutkosky rules, 267

daughter dipole, 146, 148, 151, 152, 167, 168, 244
deep inelastic scattering (DIS), 21–24, 26, 27, 29, 30, 35, 37–39, 41, 42, 63, 67, 69, 72, 74, 75, 78,

https://doi.org/10.1017/9781009291446.014 Published online by Cambridge University Press

112, 113, 116, 118, 123, 124, 198, 228, 244, 254–258, 260, 263, 270, 274, 275, 281, 287, 290, 292–295
cross section, 24, 25, 27, 35, 37, 125, 126, 129, 133, 256–258, 274, 294
diffraction, 254
central, 255
central exclusive, 255
evolution equation for, 263, 267–269
high-mass, 255, 256, 262–264, 267–269
in DIS, 255
inelastic, 255
low-mass, 255, 256, 258, 259
diffractive dissociation, 255
double, 255
single, 255
dipole BFKL kernel, 183
dipole generating functional, 141, 150–154, 167, 168
dipole–nucleus scattering, 123, 125, 127, 129–138, 140, 141, 163, 167–170, 177, 180, 195, 197, 210–212, 224, 226, 256–258, 263, 264, 267, 274, 280, 285, 288, 303
multiple nucleon interactions, 139, 172
resummation parameter, 139, 163
dispersion relations, 88, 103, 189, 312, 315
double subtracted, 88, 316
subtracted, 316
Dokshitzer–Gribov–Lipatov–Altarelli–Parisi (DGLAP) equation, 22, 43, 53, 54, 60–63, 67, 70, 72, 74–76, 86, 93, 101–103, 109, 113–115, 118, 121, 142, 143, 145, 154, 180, 181, 185, 189, 244–248, 293, 306
solution, 60, 62
double logarithmic approximation (DLA), 63–67, 69–72, 75, 76, 93, 99–101, 109, 113, 114, 118, 154, 172, 173, 175, 176, 181, 185, 197, 259

eikonal approximation, 79, 125, 126, 135, 136, 165, 192, 201, 210, 211, 276, 277, 279
exclusive vector meson production, 260, 261
extended geometric scaling, 172–176, 189, 197

Faddeev–Popov ghost field, 5
Faddeev–Popov method, 4
Feynman gauge, 6, 79, 83, 85, 90, 133, 134, 136, 163, 202, 203, 210–212, 226, 275
Feynman rules, 3–7, 14, 17, 83
QCD, 6
flavor nonsinglet distribution, 53, 63, 64
flavor singlet distribution, 54, 63, 64
Fourier transform, 19, 128, 129, 135, 138, 141, 171, 196, 206, 227, 232, 235, 276
fragmentation function, 265
Froissart–Martin bound, 107–109, 303, 304, 318
functional integral, 3, 4, 6

gauge symmetry, 3–5
geometric scaling, 172, 175, 177, 181, 183, 185, 189, 235, 239, 294, 298
Glauber–Gribov–Mueller (GGM) formula, 123, 129, 139, 141, 145, 163, 164, 167, 170, 172–174, 176, 178, 184, 192, 195, 198, 200, 204, 210, 212, 213, 218, 221, 229, 235, 250, 257, 259, 263–265, 274, 275, 277, 280, 282, 285, 292, 294, 303
gluon (parton) saturation, 114, 118, 141, 171, 172, 175, 189, 195, 214, 256, 272, 274, 289
gluon distribution, 44, 53, 58, 63, 65–70, 73, 119, 130, 131n, 131, 132, 139, 140, 174, 201, 202, 205–207, 210, 212, 214, 234, 259
gluon field strength tensor, 2
gluon multiplicity, 274
gluon production, 87, 119, 272–276, 278–283, 285, 286, 288–292
gluon propagator, 6, 56, 84, 91, 103, 135, 211, 229
gluon reggeization, 88, 91, 103–105, 107, 189, 191, 192
gluon spectrum, 282, 290, 291
Golec–Biernat–Wusthoff (GBW) model, 295
Gribov bound, 197
Gribov–Levin–Ryskin and Mueller–Qiu (GLR–MQ) equation, 74, 112, 115, 117, 118, 140, 141, 170, 171, 174–176

hadronic tensor, DIS, 25, 26, 31, 34, 41
Huygens–Fresnel principle, 252

impact factor, 83, 87
infinite momentum frame (IMF), 27, 28, 30, 40–42, 113, 119, 124, 199, 201, 202, 254
instantaneous (Coulomb) gluon, 79, 84, 165, 258
instantons, 240, 248
Ioffe time, 39, 125

Jalilian-Marian–Iancu–McLerran–Weigert–Leonidov–Kovner (JIMWLK) equation, 189, 198, 215, 216, 221, 223–226, 228–232, 240, 244, 248, 257, 264, 265, 268, 271, 285, 291, 303–306
numerical solution, 223, 225, 226

k_T-factorization, 273, 280, 282, 288, 289
Kharzeev–Levin–Nardi (KLN) model, 301
Kirchhoff integral, 252

Landau gauge, 6, 126
Landau pole, 242
Landau principle, 313
large-N_c approximation, 117, 123, 145, 147, 149, 151, 155, 166, 167, 169, 170, 189, 192, 193, 195, 224, 226, 229, 233, 244, 257, 266, 268, 271, 285–288
leading-logarithmic approximation (LLA)
in Q^2, 45, 47, 49, 50, 53, 63, 75
in x, 75, 76, 125, 142, 145, 148, 150, 163, 166, 192, 193, 215, 229, 243, 246, 263, 277, 285–287, 303
Lepage–Brodsky convention, 79, 83–85

https://doi.org/10.1017/9781009291446.014 Published online by Cambridge University Press

leptonic tensor, DIS, 25
Levin–Tuchin formula, 177, 195
light cone energy, 11, 31, 125, 126, 143, 267, 279
  denominator, 11, 47, 49
light cone gauge, 6, 8, 47, 57, 136, 142, 163, 202, 203, 205, 211, 212, 216, 227, 263, 275
light cone Hamiltonian, 9
light cone perturbation theory (LCPT), 7, 8, 10, 12, 14, 16, 17, 22, 30, 31, 46, 74, 125, 158, 165, 196, 218, 220, 231, 260, 266, 275, 278
light cone time, 10, 11, 17, 39, 71, 149, 150, 265, 277
light cone wave function, 13, 14, 17, 19, 30–32, 38, 43, 46, 48, 55, 125–127, 133, 141–143, 145, 148, 150, 151, 156, 260, 262, 275, 278
Lipatov vertex, 85
Lorenz gauge, 6, 7, 24
Low–Nussinov pomeron, 76, 80, 81, 99, 108

Mandelstam variables, 80, 121, 253, 312, 313, 317
map of high energy QCD, 188
McLerran–Venugopalan (MV) model, 198, 200, 204, 205, 213, 215, 216, 250, 257, 275, 280, 282, 290, 292, 294
Möbius transformations, 159
moment space, 54, 60, 62, 64, 73, 245
Mueller's dipole model, 123, 141, 166, 167, 198, 210, 216, 218, 226, 286, 287, 310
multi-Regge kinematics, 94, 95

next-to-leading order (NLO) corrections, 148
  BFKL, 228, 230, 242–245, 247–249
    intercept, 244
  BK, 228–230, 242, 244
  DGLAP, 63, 67, 69, 72
  JIMWLK, 229, 230
non-Abelian Weizsäcker–Williams field, 204–206
nuclear modification factor, 283, 284, 289, 290, 292, 295, 296
nuclear profile function, 132, 207, 209, 276, 277, 280
nuclear shadowing, 170, 284

odderon, 123, 192–196
onium, 78
operator expectation value, 4, 205, 215, 217, 223, 225
operator product expansion, 41
optical theorem, 89, 133, 264–267, 315, 317

parent dipole, 146, 148, 151, 152, 166–169, 231, 233
partition function, 3
parton model, 22, 27, 30, 32, 34, 37–39, 42, 45
  QCD corrections, 45
partons, 27, 29–32, 35, 37–45, 51, 57, 67, 72, 76, 93, 101–103, 113–117, 181, 200, 216, 238, 246, 247, 282, 290, 304
photon wave function, DIS, 126, 128, 129, 258
pomeron, 80, 121, 122, 192, 195, 254, 270
  intercept, 80, 81
  trajectory, 80
  trajectory slope, 80
pomeron fan diagrams, 116, 117, 304
pomeron loop diagrams, 116, 117, 304
powers of energy counting rules, 76–78

QCD Lagrangian, 1–3, 8
quark distribution, 34, 35, 37, 43–50, 52, 53, 56, 58, 60, 63, 67–69, 141, 205
quark propagator, 6, 83, 84, 136, 137, 218
quark–antiquark dipoles, 123–127, 129, 130, 133, 137–142, 145, 147–149, 151, 154, 155, 157, 163–168, 170–173, 176, 189, 191, 195, 225, 231, 233, 234, 244, 256, 258, 262, 263, 266, 267, 271, 286, 287
quark–gluon plasma (QGP), 298, 305

rapidity, 38, 83, 86, 87, 93, 95, 98, 110, 112, 116, 117, 119, 125, 129, 139, 150, 151, 155, 164, 168–175, 177, 184, 185, 187, 188, 192, 195, 206, 215, 216, 220, 225, 235, 236, 238, 245, 246, 262, 268, 279, 285–287, 289, 292, 295, 296, 299, 301, 303, 305
rapidity gap, 250, 254–256, 260, 263, 265, 266, 268
reggeized gluon, 91
  exchanges, 189, 243
renormalons, 240, 241, 248
running-coupling BK (rcBK) equation, 232–236, 295, 301
  kernel, 233, 234
  numerical solution, 236
  semiclassical solution, 236–239
running-coupling BFKL (rcBFKL) equation, 231, 232, 234, 235
  kernel, 233
running-coupling JIMWLK (rcJIMWLK) equation, 229, 234

saddle point, 65, 99, 122, 173–176, 249, 304
saddle point approximation, 65–67, 73, 99–101, 173, 174, 195, 243
saturation region, 120, 121, 172, 174–177, 180, 182, 183, 185, 189, 197, 214, 225, 240, 290
saturation scale, 74, 112, 114, 119, 120, 123, 140, 141, 169, 173–176, 180, 183–185, 187, 189, 196, 197, 199, 200, 209, 210, 213, 215, 228, 235, 236, 248, 249, 256, 259, 270, 275, 281, 290, 298, 301
  running-coupling, 236, 238
Schwinger–Keldysh formalism, 265
semiclassical approximation, 178–180, 237–239
space–time structure, DIS, 38, 39, 41, 72, 124
splitting function, 51–60, 62–64, 70, 72, 93, 249
structure functions, 22, 26, 27, 29, 34, 35, 37, 43, 63, 64, 67, 126, 127, 129, 163, 197, 243, 250, 294
SU(3) structure constants, 2

https://doi.org/10.1017/9781009291446.014 Published online by Cambridge University Press

twist, 41, 100, 122, 183, 242, 246, 247, 249, 259

unintegrated gluon distribution, 101, 102, 117, 130, 171, 206, 207, 212–215, 227, 234, 235, 240, 272, 273, 282, 284, 288, 292
unitarity constraints, 50, 51, 56, 59, 74, 107, 109, 110, 112–115, 133, 145, 185, 267, 303, 312, 316–318

vertex
  cut (Mueller), 34
  effective (Lipatov), 83, 86, 87, 93, 104, 273, 282
  four-gluon, 7, 11
  ghost–gluon, 7
  quark–gluon, 7, 11
  three-gluon, 7, 11, 85
  triple BFKL pomeron, 117, 121, 170
virtual corrections, 20, 43, 45, 50–52, 55, 56, 59, 88, 91, 93, 104, 114, 145–147, 151–153, 170, 196, 219, 220, 229, 231, 235, 286, 287

wee partons, 42, 113, 114
weight functional W, 205, 215, 217, 223
Wilson line, 202, 203, 204, 207–212, 217, 219–221, 223–225, 267, 277, 279, 285
  adjoint, 207, 209, 211, 223
  fundamental, 207, 211, 223, 267

Yang–Mills equations, 200, 202, 216, 217, 275, 290
  solution, 202, 203, 290

https://doi.org/10.1017/9781009291446.014 Published online by Cambridge University Press

https://doi.org/10.1017/9781009291446.014 Published online by Cambridge University Press