

Index

- (p, q) string, 155
- $ISO(1, 3)$ symmetry, 199
- $P(X)$ theory, 58, 70, 206, 299
- R^2 inflation, 56
- S -matrix, 319
- $SO(2, 4)$ symmetry, 199
- $SO(4, 1)$ symmetry, 5
- $T^{1,1}$ manifold, 161
- Λ CDM model, 18
- α' corrections, 99, 108, 232, 238
- α' expansion, 75, 135
- σ -model expansion, 75
- f_{NL} parameter, 24
- $\mathcal{N} = 4$ super-Yang–Mills theory, 201
- 't Hooft coupling, 195
- accidental symmetry, 36
- adiabatic limit, 150
- adiabatic perturbations, 6, 27, 291
- adiabatic vacuum, 49
- Adler zero, 25
- ADM formalism, 313
- AdS/CFT correspondence, 201
- anisotropic compactification, 146
- anthropic principle, 43
- anti-D3-brane, 113
- anti-de Sitter space (AdS), 158
- approximate supersymmetry, 125, 128
- arithmetic genus, 103
- Ashok–Douglas formula, 121
- assisted inflation, 210
- axiodilaton, 90
- axion, 91, 134
- axion decay constant, 93, 208
- axion inflation, 208
- axion monodromy inflation, xvii, 215, 250
- B-modes, 15
- backreaction, 66, 82, 102, 135, 138, 141, 146, 162, 165, 167, 181, 202, 204, 217, 222, 223
- baryon acoustic oscillations (BAO), 16
- Berger's classification, 267
- Betti number, 272, 281
- Bianchi identity, 96
- biasing, 16
- bispectrum, 24
- blow-up, 109
- blow-up inflation, 233
- Born–Infeld action, 81
- bosonic string theory, 74
- Bousso–Polchinski mechanism, 122
- BPS object, 82
- brane polarization, 116
- brane tension, 82
- Breitenlohner–Freedman bound, 128
- bremsstrahlung, 205, 256
- broken time translations, 5, 290
- bubble nucleation, 252
- Bunch–Davies initial condition, 316
- Bunch–Davies vacuum, 9, 49
- bundle, 265
- Calabi–Yau compactification, 87, 94, 282
- Calabi–Yau manifold, 84, 109, 110, 268, 281
- chaotic inflation, 52
- charm quark, 41
- Chern class, 281
- Chern–Simons action, 80, 82, 258
- chiral gravitational waves, 229
- chiral Lagrangian, 286
- chromo-natural inflation, 261
- closed form, 270
- CMB experiments
 - ABS, 22
 - ACTpol, 22
 - Atacama Cosmology Telescope, 18
 - BICEP2, 22
 - CLASS, 22
 - EBEX, 22
 - KeckArray, 22
 - Planck satellite, xv, 18
 - POLARBEAR, 22
 - South Pole Telescope, 18
 - SPIDER, 22
 - SPTPol, 22
 - WMAP satellite, xv, 18
- cohomology, 270
- cold dark matter (CDM), 18
- Coleman–Weinberg potential, 187, 232

comoving curvature perturbation, 312	deformed conifold, 161
comoving gauge, 6, 292, 312, 323	DeWolfe–Giddings Kähler potential, 99, 143, 187, 193
compactification, 83	differential forms, 268
compactification effects, 169	dilatation symmetry, 199, 290
compactification volume, 90	dilaton, 75
complex manifold, 276	dimensional reduction, 85
complex structure, 276, 277	Dine–Seiberg problem, 103
complex structure moduli, 88, 134, 284	Dirac action, 81
complexified tangent space, 277	Dirac–Born–Infeld action, 81, 216
conformal gauge, 75	Dirichlet boundary conditions, 80
conformal time, 1	dissipation, 243, 307
conical defect, 153	Dolbeault cohomology, 278
cosmic microwave background (CMB)	Dolbeault operators, 278
acoustic oscillations, 13	
anisotropies, 12	E-modes, 15
decoupling, 12	effective action, 34
last scattering, 12	effective field theory (EFT), xvi, 33
polarization, 14	EFT of inflation, 296
power spectrum, 13, 14	EFT of large-scale structure, 31
recombination, 12	eigenvalue spectrum, 124, 127
Thomson scattering, 12, 14	Einstein frame, 80
cosmic strings, 153, 184	Einstein manifold, 161
intercommutation, 153	elliptic fibration, 102
Nielsen–Olesen strings, 154	energy scale of inflation, 11
scaling, 153	entropy perturbations, 8, 150, 208, 312, 323, 329
cosmic variance, 13	eta problem, 60–62, 138, 141–143, 158, 165, 172, 219, 221, 236
cosmological constant problem, 43, 46	eternal inflation, xviii, 263
Coulomb branch, 201	Euclidean D-branes, 93, 102, 109, 220
Coulomb potential, 140, 164, 203	Euler characteristic, 272
Coulomb self-energy, 40	exact form, 270
curvaton scenario, 151	exceptional divisor, 109
curvature, 20	exceptional holonomy, 268
curvature coupling, 165	extended no-scale structure, 232, 235
curvature perturbations, 6, 9, 51	exterior derivative, 269
cutoff, 34, 38	extremal p -brane, 82
cycle, 271	extremal black hole, 82
	extrinsic curvature, 292–294, 296, 313
D-brane, 80	
D-brane inflation, xviii, 133, 157	F-string, 155
D-string, 155	F-term potential, 85
D-term inflation, 143, 187	F-theory, 102
D3-brane potential, 164	Fermi theory, 33
D3/D7 inflation, 186	fiber bundle, 265, 266
dark energy, xv, 43, 111	fiber inflation, xviii, 236
dark matter, xv, 18	field range bound, 163, 204
DBI inflation, xvii, 59, 133, 195, 251	fine-tuning, 36, 41, 43, 44, 61, 105, 107, 142, 143, 156, 168, 178, 193, 230
IR model, 196	flatness, 20
UV model, 196	flattening, 148, 217
de Rham cohomology, 270	flux cascades, 251
de Rham’s theorem, 271	flux compactification, 95
de Sitter space, 290	flux superpotential, 108, 111
de Sitter vacua, 111	
decoherence, 13	
decoupling, xvi, 38	
decoupling limit, 290, 296, 298	

- fluxbrane inflation, 189
- four-cycle volume, 90
- Friedmann equation, 4, 50, 59
- FRW metric, xv, 1
- galaxy bias, 16
- galaxy lensing tomography, 32
- Galileon inflation, 71, 304
- gauge-flation, 257
- gaugino condensation, 101, 221
- Gauss’s law, 141
- Gauss–Bonnet theorem, 45
- Gauss–Codazzi relation, 293
- generalized Lyth bound, 307
- genus expansion, 76
- ghost inflation, 304
- GKP compactification, 95
- global symmetries
 - in quantum gravity, 46
 - in string theory, 47
- Goldstone action, 5, 7, 25, 207, 286, 296–298, 300–302, 304, 305, 322
- Goldstone boson, 5, 286
- Goldstone equivalence theorem, 290
- Goldstone’s theorem, 286
- gravitational wave experiments
 - LIGO, 153
 - Virgo, 153
- gravitational waves, 10
- gravity as an effective theory, xvi, 44
- GSO projection, 77
- Gukov–Vafa–Witten superpotential, 98, 105
- harmonic form, 273, 275
- Hermitian manifold, 279
- Hessian matrix, 123
- hierarchy problem, 38, 42
- Higgs inflation, 57
- higher-derivative terms, 199
- hilltop inflation, 54
- Hodge decomposition, 274
- Hodge numbers, 279, 283
- Hodge star, 273
- Hodge theory, 273
- Hodge’s theorem, 274
- holonomy, 266, 267
- homology, 270, 271
- horizon crossing, 8
- horizon problem, xv, 2
- Hubble parameter, xv
- Hubble slow-roll parameters, xxi
- Hubble sphere, 3
- hybrid inflation, 55
- hypermultiplet, 88, 91
- imaginary self-dual (ISD) flux, 96
- in–in formalism, 319
- induced metric, 292, 293, 313
- inflection point inflation, 55, 168, 180, 194
- instabilities, 110
- integrating out, 35
- interaction picture, 320
- intrinsic curvature, 292, 293, 313
- invariant spinor, 84, 268, 282
- irrelevant operator, 36
- ISD solution, 97
- isocurvature perturbations, 21, 27
- K-inflation, xvii, 58
- Kähler coordinates, 90, 91
- Kähler form, 87, 89, 280
- Kähler manifold, 268, 279, 280
- Kähler metric, 85
- Kähler moduli, 86, 87, 134, 284
- Kähler moduli inflation, 134, 229
- Kähler potential, 85, 280
- Kähler transformation, 280
- Kaiser–Stebbins effect, 153
- Kaluza–Klein reduction, 85
- Kaluza–Klein relics, 177
- Kaluza–Klein scale, 131
- Kibble mechanism, 153
- kinematic basis, 325
- KKLT scenario, 105
- Klebanov–Strassler throat, 113, 162
- Klein–Gordon equation, 50, 59
- Kuperstein embedding, 168
- lapse function, 313
- large charge approximation, 136
- large volume expansion, 137
- Large Volume Scenario, 105, 108, 109, 231
- large-field inflation, xvii, 52, 63, 65, 144, 164, 192, 206, 209, 210, 215, 236
- large-scale structure (LSS), 16, 30
- Lichnerowicz equation, 283
- LSS experiments
 - BigBOSS, 31
 - Cosmic Inflation Probe, 31
 - EUCLID, 31
 - HETDEX, 31
 - Sloan Digital Sky Survey, 16
 - WFIRST, 31
- Lyth bound, 63, 307
- M-theory, 78
- M5-brane inflation, 192
- magnetic drift, 256
- Marčenko–Pastur law, 126, 213
- marginal operator, 36
- measure problem, xviii, 263

- minimal coupling, 48
- modulated power spectrum, xvii, 225
- modulated reheating, 151
- moduli, xviii, 87, 94, 283
- moduli stabilization, 94, 103, 135, 138, 189, 219
- moduli trapping, 245
- monodromy, xvii, 215, 248
- Mukhanov–Sasaki equation, 7, 315
- multi-field inflation, 132, 150, 182, 208, 323
- N-flation, 210
- natural inflation, xvii, 53, 208
- natural units, xxi
- naturalness, 39
 - bottom-up, 39
 - top-down, 39
- negative tension source, 96
- Neumann boundary conditions, 80
- Neveu–Schwarz sector, 77
- Newtonian gauge, 312
- nilmanifold, 217, 248
- no-scale structure, 98, 104
- Noether current, 287
- non-decoupling, 138
- non-Gaussianity, 22, 23, 30, 70, 319
 - equilateral, 26, 206, 227, 322
 - local, 25
 - orthogonal, 26
 - resonant, 226
- non-minimal coupling, 57
- noncompact approximation, 137
- nonlinear σ -model, 75
- nonlinearly realized symmetry, 5
- nonperturbative superpotential, 101, 105, 108
- NS5-brane, 80, 216
- null energy condition (NEC), 49
- orientifold plane, 89, 185
- overshoot problem, 179
- particle horizon, 2
- particle production, 244
- Peccei–Quinn symmetry, 91
- perturbative unitarity, 33, 303
- phase coherence, 21
- phase velocity, 308
- pion, 286
- pivot scale, 18, 51
- Planck scale, xvi, xxi, 34, 131
- Planck-suppressed operators, xvii, 62, 66, 72, 139, 309
- Poincaré duality, 271
- Poincaré lemma, 270
- poly-instanton inflation, 240
- Polyakov action, 74
- positron, 40
- power spectrum, xxi, 9
- preheating, 152
- primordial black holes, 228
- probe approximation, 136
- QCD axion, 91
- quasi-single-field inflation, 132, 174
- racetrack inflation, 229
- Ramond sector, 77
- Randall–Sundrum scenario, 195
- random matrix theory, 124
- random supergravity, 122
- reduced holonomy, 84, 268, 282
- Regge slope, xxii
- reheating, 151
- reheating in brane inflation, 175
- relevant operator, 36
- renormalization of the Planck mass, 146, 211, 214
- rho meson, 41
- Ricci form, 281
- Ricci-flatness, 84, 282
- rigid divisor, 103, 109
- running, 21, 30
- saddle-point inflation, 193
- scalar spectral index, 10
- scale-invariance, 10
- Schwinger process, 252
- Schwinger–Keldysh formalism, 320
- section of a bundle, 266
- sequestering, 139
- shift symmetry, xvii, 43, 62, 67, 91, 144, 211, 219
- shift vector, 313
- sigma model, 287
- single-field consistency condition, 25
- single-field inflation, 49, 132
- singular conifold, 160
- slow-roll inflation, 49
- slow-roll parameters, xxii, 50
- slow-turn approximation, 328
- smearing approximation, 115, 136
- sound horizon, 317
- spatially flat gauge, 6, 291, 292, 312, 323, 325
- special conformal transformations, 199
- special holonomy, 268
- spectral tilt, 10
- speed of sound, 7, 59, 71, 206, 300
- spherical harmonics, 13
- spin-weighted spherical harmonics, 15
- spontaneous symmetry breaking, 5, 285

- Stückelberg trick, 290, 295
- Stokes parameters, 15
- Stokes' theorem, 272
- string compactification, 83
- string coupling, 76
- string frame, 79
- string landscape, xviii, 43, 118
- string loop corrections, 99, 108, 231, 235, 237, 241
- string loop expansion, 135
- string scale, xxii, 75, 131
- string theory
 - heterotic, 78
 - type I, 77
 - type IIA, 77
 - type IIB, 77, 79
- string worldsheet, 74
- strong coupling scale, 289, 302
- strong energy condition (SEC), 4
- super-Planckian fields, 63, 65, 144
- supergravity, 78
 - $\mathcal{N} = 1$, 85, 142
 - $\mathcal{N} = 2$, 85, 87
 - type II, 78
 - type IIA action, 79
 - type IIB, 95
 - type IIB action, 80
- superhorizon correlations, 2
- superluminal propagation, 308
- superpotential, 85
- superstring theories, 76
- supersymmetry (SUSY), 43, 61
 - SUSY breaking, 113, 132
 - SUSY breaking scale, 132
- Swiss-cheese compactification, 110
- symmetry breaking scale, 287, 298, 301
- tachyon condensation, 153, 158, 176, 252
- technical naturalness, 44
- tensor fluctuations, 10, 22
- tensor spectral index, 11, 29
- tensor tilt, 11, 29
- tensor-to-scalar ratio, 11
- time translations, 290
- Tracy–Widom theory, 127
- transfer function, 14, 16
- transverse acceleration, 325
- trapped inflation, 243
- triple intersection numbers, 90
- type Ia supernovae, xv
- ultraviolet (UV) sensitivity, xvi, 60
- unitarity bound, 225, 303
- unitary gauge, 289, 292, 312
- universality, 124, 149
- unphysical singularity, 114
- uplifting, 111, 113
- vacuum fluctuations, 8
- vacuum statistics, 118, 120
- vector bundle, 266
- vector multiplet, 88
- volume stabilization, 103
- warm inflation, 243
- warp factor, 84
- warped brane inflation, 157
- warped compactification, 84
- warped deformed conifold, 162
- warped throat, 113, 162
- waterfall field, 55
- wedge product, 269
- Weyl rescaling, 79
- Weyl symmetry, 75
- Wigner ensemble, 125, 127
- Wilson coefficients, 38
- Wilsonian effective action, 35
- Wishart ensemble, 125, 213
- worldsheet instanton, 92
- worldsheet orientation reversal, 89
- WWW ensemble, 126
- zero-point fluctuations, 9