

# Index

- $\alpha$ -plane 55, 105
- $\beta$ -plane 55
- abstract indices 5
- algebraically general Weyl tensor 30
- algebraically special Weyl tensor 30
- almost complex structure 24
- ambi-twistor space 149
- anti-self-dual bivector 17
- anti-self-dual Yang–Mills equation 102
- astigmatic focussing 48
- Atiyah–Singer Index Theorem 125
- Bianchi identity 103
- bivector 6
- boost 8
- causal curve 42
- causal infinity 42
- Čech Cohomology 77
- Čech cohomology group 78
- Čech map 89
- celestial sphere 19, 57
- charge integrality 102
- charge of the Maxwell field 102
- cobord map 146
- coboundary map 77
- compactified Minkowski space 36
- compactly supported  $p$ -forms 141
- complete analytic functions 72
- complex 85, 139
- complex manifold 18
- complex projective space 18
- complex shear 47
- complex structure 24
- complexified compactified Minkowski space 58
- conformal curvature 105
- conformal group 33
- conformal invariance 41
- conformal Killing vector 9, 33
- conformal rescaling 41
- connecting map 86
- contorted surface 126
- contour integral formulae for z.r.m. fields 67
- correspondence 156
- $\mathbb{C}P^n$  22
- cut of the future null cone 20
- de Rham cohomology 139
- de Rham cohomology group 86
- de Sitter space 43, 63
- deformation of a complex manifold 111
- density of elementary states 69
- dilation 34
- Dirac equation 31
- Dolbeault cohomology 139
- Dolbeault cohomology groups 89
- Dolbeault complex 140
- Dolbeault form, of type  $(0, 1)$  88

- Dolbeault lemma 88
- double fibration 63, 91, 106
- Dougan–Mason construction 134
- dual of a bivector 7
- dual sheaf 142
- dual twistor 55, 61
- dyad 15
- eigen-bivectors 7
- Einstein field equations 8, 29
- Einstein Static Universe 38
- Einstein–Weyl equations 149
- elementary states 69
- eth 124
- Euler operator 60
- fine resolution 88
- fine sheaf 85
- first Bianchi identity 8
- flag-pole 17
- Friedmann–Robertson–Walker cosmologies 130
- function element 71
- future tube 63
- future/past null infinity 39
- future/past time-like infinity 39
- geodesic deviation 46
- geodesic shear-free condition 105
- geodesic shear-free congruence 49
- germ 72
- GHP equations 163
- GHP formalism 123
- Goldberg–Sachs theorem 49
- Grassmann manifold 22
- Gravitational energy 119
- helicity 31, 67
- hermitian spinor 14
- holomorphic deformation 111
- homogeneity operator 106
- hypersurface-orthogonal vector field 50
- infinitesimal generators of  $SU(2, 2)$  59
- infinity twistor 57, 64
- inner product on twistor space 54
- integrable almost complex structure 24
- integrable equations 148
- inverse twistor function 96
- Jacobi field 45
- Kerr Theorem 50, 60
- kinematic twistor 121
- Klein representation 58
- Klein–Gordon equation 69
- Leray covers 84
- Lie derivative 9
- Lie derivative of a spinor 33, 39
- line bundles over  $\mathbf{PT}$  99
- line bundles over  $\mathbf{CP}^1$  23
- linearised general relativity 120
- Lorentz group 7
- massive fields 69
- massless neutrino equation 31
- Mayer–Vietoris sequence 89
- momentum and angular momentum 120
- momentum–angular momentum twistor 121
- Moving Sphere 21
- negative frequency 31
- Newlander–Nirenberg Theorem 24
- Newman’s  $H$  space 149
- non-contorted surface 126
- normal bundle 107

## INDEX

177

- normalisability of elementary states 69
- normalised dyad 15
- null bivector 22
- null cone 6
- null flag 17
- null geodesic congruence 45
- null geodesics in twistor terms 56
- null Maxwell field 31
- null separation of points in twistor terms 57
- null tetrad 15
- null twistor 55
  
- orientability 25
- orthonormal frame bundle 25
  
- $p$ -coboundaries 78
- $p$ -cochain 77
- $p$ -cocycles 78
- past of a set 42
- Petrov–Pirani–Penrose classification 29
- Poincaré duality 141
- Poincaré group 34
- polar decomposition 153
- positive frequency 31, 118
- positive-frequency field 67
- potentials for z.r.m. fields 95
- primed spin bundle 91
- principal null directions 16, 29
- projective null cone 19
- projective spinors 18
- projective twistor space 55, 63
- proper orthochronous Lorentz group 7
- $PT, PT^+, PT^-$  56
  
- refinement 83
- Reissner–Nordström space-time 129
- relative cohomology 142, 147
- Relative Dolbeault cohomology 142
- relative exact sequence 142
- resolution 84
- Ricci identity 8
- Ricci scalar 8
- Ricci tensor 8
- Riemann surface 72
- Robinson congruence 61
- $RP^n$  22
  
- Sachs equations 48, 106
- scalar product of fields 138
- scalar-flat, Kähler manifolds 148
- Schwarzschild space-time 129
- screen-space 46
- second Bianchi identity 9
- section of a bundle 23
- section of a sheaf 74
- self-dual bivector 17, 32
- self-dual Killing vector 120
- Serre duality 82
- sheaf 75
- sheaf homomorphism 75
- sheaf of germs of holomorphic functions 72
- shear 47, 49
- shear-free congruences 49
- short exact sequence 76
- simple bivector 9
- $SL(2, \mathbb{C})$  11
- small-sphere 131
- source-free Maxwell equations 30
- space-like infinity 39
- special conformal transformations 34
- spherical lamp-shade 13
- spin coefficients 123
- spin-and-statistics theorem 148
- spin-lowering 32, 121
- spinor 13
- spin-raising 32

- spin-space 13
- splitting 81, 102, 104
- splitting formulae 80
- stalk 75
- stereographic projection 19
- $SU(2, 2)$  54
- symmetric spinors 16
- symmetrisation 5
- $T, T^+, T^-$  56
- thorn 124
- time-orientability 25, 26
- topological obstruction to  
   building spin bundle 27
- torsion-free connection 111, 118
- totally null 2-plane 55
- transition function 19
- transition matrix 104
- twisted photon 99
- twistor 53, 60
- twistor conformal field theory  
   148
- twistor diagrams 137, 147
- twistor equation 31
- twistor internal symmetry  
   groups 148
- twistor space 53, 54
- two-surface twistor 122
- two-surface twistor equations 122
- weighted scalars 123
- Weyl spinor 29
- Weyl tensor 29
- Witten–Nester integrand 133
- Yang–Mills field 102
- Yang–Mills field equations 103
- zero rest mass free field  
   equations 31