

# Subject index

- adiabatic scattering operator, 574
- adiabatic dynamics, 574
- advanced Green's function, 499, 507, 518
- affiliated, 149
- annihilation operators, 75
- annihilator, 10
- anomalies, 413
- anomaly-free orthogonal group, 396
- anomaly-free symplectic group, 271
- anti-dual pair, 20
- anti-Feynman Green's function, 499, 507
- anti-Hermitian form, 21
- anti-holomorphic derivative, 94
- anti-holomorphic polynomials, 83
- anti-holomorphic subspace, 26
- anti-intertwining, 316
- anti-involution, 23
- anti-orthochronous, 514
- anti-self-adjoint operator, 13
- anti-symmetric, 13, 41
- anti-symmetric calculus, 159, 163
- anti-unitary, 22
- anti-Wick ordering, 226
- anti-Wick quantization, 227, 346
- anti-Wick symbol, 227, 346
- Araki–Woods representation, 437
- Araki–Wyss representation, 453
- asymptotic fields, 657
  
- Baker–Campbell formula, 214
- Bargmann kernel, 169, 236
- Bargmann representation, 238
- Berezin calculus, 163
- Berezin integral, 162
- Bogoliubov automorphism, 191
- Bogoliubov rotation, 179, 319
- Bogoliubov transformation, 179, 406
- Bogoliubov translation, 179
- Bose gas, 441
- bosonic Fock space, 67
- bosonic Gaussian vector, 278
- bosonic harmonic oscillator, 261
- Brownian motion, 607
  
- CAR algebra, 324, 331–333
- CAR representation, 314
  
- Cauchy hypersurface, 539
- causal, 513
- causally separated, 514
- Cayley transform, 34
- CCR representation, 174
- characteristic functional of a measure, 122
- charge 1 symmetry, 31
- charge operator, 485
- charge reversal, 375, 488
- charged CAR representation, 318
- charged CCR representation, 184, 185
- charged dynamics, 484
- charged field operators, 185, 319
- charged symplectic dynamics, 485
- charged symplectic space, 22
- Clifford algebra, 325, 369
- Clifford relations, 374
- Clifford representation, 368
- co-isotropic, 14
- coherent representation, 303
- coherent sector, 304
- coherent state, 204
- coherent states transformation, 204
- commutant, 145
- commutant theorem, 149
- complete Kähler space, 29
- complete lattice, 468
- complete measure space, 113
- complex-wave CCR representation, 217
- complex-wave CAR representation, 342, 344
- concrete  $C^*$ -algebra, 145
- conditional expectation, 116, 150, 158
- conjugate vector space, 18
- conjugation in a complex vector space, 17
- conjugation in a Kähler space, 30
- conjugation in a symplectic space, 16
- connected diagram, 562
- conserved current, 541, 543, 550
- convergence in measure, 117
- covariance (of a measure), 124
- covariance (of a quasi-free state), 424
- covariant quantization, 208
- creation operators, 75
- cyclic set, 146

- cylinder function, 122  
cylinder sets, 121
- det-implementable, 361  
det-implementing, 359  
det-intertwining, 361  
determinant, 88  
Dirac equation, 504, 525, 527  
Dirichlet form, 178  
doubly Markovian map, 116  
dressing operator, 309  
dual pair, 10  
Dyson time-ordered product, 571
- equi-integrable family, 118  
essentially self-adjoint, 51  
Euclidean Green's function, 501, 508  
exponential law, 70  
external legs, 563
- factor, 148  
factorial representation, 146  
faithful representation, 145  
faithful state, 147  
FBI transform, 204  
Feldman–Hajek theorem, 136  
Fermi gas, 460  
fermionic Gaussian vector, 402  
fermionic harmonic oscillator, 354  
Feynman Green's function, 499  
Feynman's phase space 2-point function, 591  
Feynman–Kac–Nelson kernel, 619  
Fourier transform, 96  
Fréchet differentiable, 45  
Fredholm determinant, 44  
Friedrichs diagram, 577  
fundamental solution, 499, 507  
future oriented, 513
- Gâteaux differentiable, 44  
Gaussian coherent vector, 209, 216  
Gaussian FBI transform, 218  
Gaussian integrals, 97  
Gaussian integrals for complex variables, 97  
Gaussian measure on a complex Hilbert space, 137  
Gaussian measure on a real Hilbert space, 133  
Gaussian path space, 612, 614  
Gelfand–Najmark–Segal theorem, 148  
Gell-Mann–Low scattering operator, 574  
generalized path space, 610  
generating function, 260  
Gibbs state, 433, 449
- Glauber's coherent vector, 210, 216  
globally hyperbolic manifold, 540  
GNS representation, 148  
grading, 15  
Green's function, 499, 507  
grounded Hilbert space, 62
- Hermite polynomial, 223  
Hermitian form, 21  
higher-order estimates, 657  
Hilbert–Schmidt operator, 43  
Hodge star operator, 86  
Hölder's inequality, 115, 157  
holomorphic derivative, 94  
holomorphic polynomials, 83  
holomorphic subspace, 26  
hyper-contractive map, 116
- implementable, 149, 283, 361  
inextensible curve, 537  
infinitesimally symplectic, 14  
intertwiner, 146  
irreducible algebra, 145  
irreducible representation, 146  
isotropic, 11
- Jordan–Wigner representation, 321
- Kähler anti-involution, 29  
Kähler space, 29  
Kaplansky density theorem, 149  
Kato–Heinz theorem, 48  
Klein–Gordon equation, 493, 495–497  
KMS condition, 153  
KMS state, 153  
Kohn–Nirenberg quantization, 107
- Lagrangian, 518, 527  
Lagrangian subspace, 13  
Lebesgue–Vitali theorem, 118  
light-like vector, 513  
linked cluster theorem, 569, 585  
Liouville volume form, 86  
Liouvillean, 152  
local Hermitian semi-group, 49
- Majorana subspace, 489  
Markov path space, 610, 624  
Matsubara coefficients, 503, 510  
maximal accretive, 49  
metaplectic group, 252  
Minlos–Sazonov theorem, 128  
modified Fock spaces, 84  
modular conjugation, 153  
modular operator, 153

- modular theory, 152
- moments of a measure, 120
- multi-degree, 559
- multiple annihilation operators, 78
- multiple creation operators, 78
  
- Nelson's analytic vectors theorem, 52
- Nelson's commutator theorem, 51
- Nelson's hyper-contractivity theorem, 226
- Nelson's invariant domain theorem, 51
- net, 36
- non-commutative probability space, 155
- normal operator, 46
- number operator, 65
- number quadratic form, 294
  
- orientation, 89
- orthochronous, 514
- oscillator space, 247
  
- pairings, 90
- parity operator, 65, 201, 202
- parity reversal, 523
- partial conjugation, 392
- partial isometry, 53
- past oriented, 513
- Pauli matrices, 320
- Pauli–Jordan commutator function, 499, 519
- Perron–Frobenius theorem, 116
- Pfaffian, 91
- Pin group, 358, 360, 364
- Poincaré group, 514
- Poisson bracket, 240
- polar decomposition, 53
- polynomial CCR algebra, 189
- positive energy quantization, 481, 483, 487, 488
- positive symplectic transformation, 269
- positivity improving map, 116
- positivity preserving map, 116
- pre-annihilator, 10
- pre-measure, 113
- probability measure, 112
- pseudo-Euclidean space, 12
- pseudo-Kähler space, 29
- pseudo-quaternionic, 375, 532
- pseudo-real, 375, 532
- pseudo-Riemannian manifold, 539
- pseudo-unitary space, 21
- pullback of distributions, 93
  
- quasi-free CCR representation, 424
- quaternionic representation, 374
- quaternionic spinor, 374
- quaternions, 370
  
- Racah time reversal, 491
- Radon–Nikodym derivative, 120
- real Hilbert space, 12
- real-wave CAR representation, 329, 334, 340
- real-wave CCR representation, 220, 221
- reconstruction theorem, 611
- regular CCR algebra, 193
- regular CCR representation, 174
- regular symplectic map, 241
- regularized determinant, 44
- restricted orthogonal group, 394
- restricted symplectic group, 271
- retarded Green's function, 499, 507, 518
- Riesz spectral projection, 45
- right derivative, 81
  
- scattering operator, 572
- Schrödinger representation, 176
- Schwartz kernel theorem, 99
- Schwartz space, 93, 181
- Schwinger term, 277, 400
- second quantization, 68
- Segal field operators, 180
- semi-direct product, 33
- separating subset, 146
- Shale theorem, 274, 283
- Shale–Stinespring theorem, 407, 418
- sharp-time fields, 614
- Slater determinant, 339
- space-compact, 513
- space-like vector, 513
- spinor structure, 549
- standard representation, 152
- state, 147
- Stokes theorem, 538
- Stone–von Neumann CCR algebra, 190
- Stone–von Neumann theorem, 104
- Sucher's formula, 575
- super-algebra, 144
- super-Fock space, 72
- super-Hilbert space, 15
- super-space, 15
- symplectic form, 14
- symplectic space, 14
  
- tensor product of  $C^*$ -algebras, 151
- tensor product of  $W^*$ -algebras, 151
- thermal Euclidean Green's function, 502, 509
- time orientation, 539
- time reversal, 483
- time-like vector, 513
- time-zero fields, 611
- Tomita–Takesaki theory, 152

- trace-class operator, 43
- tracial state, 147
- transpose of an operator, 10
- Trotter's product formula, 52
- two-fold covering, 257
  
- unitary space, 21
  
- vacua of a CAR representation, 417
- vacua of a CCR representation, 288
- van Hove Hamiltonian, 306, 309
- volume form, 85
- von Neumann algebra, 148
- von Neumann density theorem, 149
  
- wave operators, 572
- weak characteristic functional, 128
- weak distribution, 127
- weakly stable, 479
- Weyl CCR algebra, 194
- Weyl operator, 174
- Weyl–Wigner quantization, 198
- Weyl–Wigner symbol, 200
- Wick quantization, 227, 346
- Wick rotation, 502, 509
- Wick symbol, 227
- Wick theorem, 198, 223, 328
- Wick's time-ordered product, 590
- Wigner time reversal, 490



