CAMBRIDGE

Cambridge University Press
978-1-107-04342-8 — Quantum Theory from First Principles
Giacomo Mauro D'Ariano , Giulio Chiribella , Paolo Perinotti
Index
More Information

Index

adjoint
  representation, 82
  map, 35
ancilla-assisted tomography, 54
anyons, 113
arrow of time, 142
atomic
  effect, 24
  instrument, 46
  point in a convex cone, 23
  state, 24
  transformation, 24, 43
atomicity of composition, 130

$\mathsf{B}_s(\mathcal{H})$, 14
Banach spaces
  of operators, 74
base of convex cone, 146
Bell measurement, 33, 41
Bhatia dilation of effect, 83
Bloch
  ball, 18
  sphere, 18

Carathéodory's theorem, 173
category theory, 5
  strictly symmetric monoidal, 5
causal chain, 142
causality, 20, 135
  axiom, 141
  causal theories, 141
  in philosophy, 6
  no signaling from the future, 142
  philosophy, 139
CB norm, 123, 128
central extension, 100
channel, 119
  correctable upon input, 66
  correlation-erasing, 66
  purification-preserving, 66
Choi–Jamiołkowski
  isomorphism, 41
  operator, 41
circuit, 112
classical theory, 49
closed circuits, 115, 125
  event, 119
  test, 119
coarse-graining, 13, 22, 119
cocycle, 100
commuting POVM, 59
complementary channel, 67
complete OPT, 149
complete positivity, 36
completely bounded map, 128
completely bounded norm, 123
completely mixed state, 34, 54, 132
completely positive map, 36
composite system, 113
compression
  efficient, 134
  ideal, 34, 134
  lossless, 134
conditional preparation, 145
conditional state, 19, 38, 43
conditioned test, 142
conditioning-equivalent transformations, 149
conic combinations, 117
conservation of information, 170
contractive operator, 44
convex
  OPT, 149
  refinement, 23
  refinement set, 23
CP, 42
CP map, 36
  iff condition, 84

dagger correspondence, 229
decoding, 134
deletion channel, 66
density matrix, 16
density operator, 16
deterministic OPT, 148
diamond norm, 123, 128
directed acyclic graph, 4
discrimination, 121
dissipative evolution, 107
double-covering, 102
double-ket notation, 39
dual set, 28

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-04342-8 — Quantum Theory from First Principles
Giacomo Mauro D'Ariano , Giulio Chiribella , Paolo Perinotti
Index
More Information

effect, 13, 116
  Bhatia dilation, 83
  deterministic, 14
  identifying a pure state, 230
  local, 27
  partial ordering, 144
  separating, 25
Eff(A), 13
Einstein locality, 151
embedding, 79
encoding, 134
  efficient, 195
  ideal, 196
  ideal scheme for a face, 196
  lossless for a state, 134
  lossless upon input of ρ, 195
encoding space, 66
ensemble of states, 17
entangled
  effect, 30
  state, 30
entanglement, 157
  entropy of, 32
  from purification, 172
entropy of entanglement, 32
environment, 55, 61
environment-correctable channel, 72
equal upon input of the source $\{p_x\rho_x\}_{x\in\mathsf{X}}$, 193
equal upon input of ρ, 53, 194
error correctable upon input of ρ, 201
error correction, 66
error-correcting code
  degenerate, 72
  non-degenerate, 72
event, 111
  coarse-grained, 119
  deterministic, 112
  independent, 116
  probabilistic, 112
everything not forbidden is allowed, 184
extremal, 23
  effect, 24
  point in a convex set, 22
  ray in a convex cone, 22
  state, 24
  transformation, 24

face
  identified by ρ, 194
  of a convex cone, 24
  of a convex set, 23, 33, 147
  orthogonal, 282
faces
  perfectly discriminable, 219
faithful state, 54
Frobenius product, 40

Golden rule for quantum extensions, 80
group of reversible transformations, 173

Heisenberg picture, 37
holism, 157
  of transformations, 158

ideal compression, 34, 133, 134
identity test, 113
independent
  events, 116
  systems, 115
informational dimension, 246
informationally complete
  observation test, 28
  POVM, 75
  preparation test, 30
  set of effects, 28
  test, 147
instrument, 115
  atomic, 46
  measure-and-prepare, 46
  repeatable, 46
  von Neumann–Lüders, 46
interaction, 114
internal
  in a convex set, 23
  state, 34, 132
invariant state, 174
Iso, 41
isometric transformation, 42
isometries, 79

Jacobi identities, 100
Jordan decomposition, 83

Ker, 19
Klein group, 101
Knill–Laflamme condition, 70
Kraus form
  canonical, 42
  minimal, 42
  of a CP map, 42

Lie
  algebra, 82
  product, 82
Lin($\mathcal{H}$), 14
Lindblad equation, 78, 85
Lin$_+$($\mathcal{H}$), 14
Liouville equation, 84

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-04342-8 — Quantum Theory from First Principles
Giacomo Mauro D'Ariano , Giulio Chiribella , Paolo Perinotti
Index
More Information

local
  discriminability, 136
  discriminability axiom, 159
  discriminability over pure states, 164
  effect, 27
  state, 27, 148
  tomography, 136
local tomography property, 163
locality in Einstein sense, 151

map
  adjoint, 35
  completely positive, 36
  positive, 36
  rank of, 42
  sub-unital, 37
  trace-non-increasing, 36
  unital, 37
marginal state, 20, 148
Markov condition, 106
master equation, 85
maximal set of perfectly discriminable pure states in F, 247
maximally entangled state, 33, 41
measure-and-prepare instrument, 46
measure-and-reprepare test, 143
minimal purification, 199
Moore–Penrose pseudoinverse, 104
morphism, 79

n-local
  tomography, 164
  discriminability, 164
Naimark
  canonical dilation, 59
  dilation, 59
  minimal dilation, 59
no disturbance without information, 218
no information upon input of ρ, 220
no information without disturbance, 54, 177
no signaling from the future, 142
no-restriction hypothesis, 16
non-disturbing test, 54

observable, 18, 59, 75
  von Neumann's, 19
observation
  event, 114
  test, 12, 114
  test, von Neumann's, 146
one-parameter Abelian channel semigroup, 106
one-parameter Abelian unitary group, 106
operational distance
  between effects, 122
  between states, 120
  between transformations, 122
operational norm, 121
  closure, 121
  monotonicity, 122
operational probabilistic theory, 4
operational probabilistic theory (OPT), 111, 116
  complete, 149
  convex, 118, 149
  deterministic, 116, 148
operationally equivalent, 113
OPT, 111
orthogonal faces, 282
orthogonal states, 225
outcome, 12, 112
  space, 112

parallel composition, 114
partial ordering, 15, 23
perfect discriminability, 132
perfectly discriminable faces, 219
pointer, 61
polarization identity, 15, 80
positive map, 36
positive operator, 14
post-processing, 19
post-selection, 21, 145, 151
POVM, 18
  commuting, 59
  dilation, 59
  extension, 59
  infinite dimension, 74
PPT criterion, 31
predual, 74
preparation, 12
  event, 114
  test, 12, 114
  test, informationally complete, 30
prior state, 17
probabilistically-equivalent transformations, 150
probability space, 112
process tomography, 176
Proj, 34
projective unitary representation, 81
property, 19
Pur, 57
pure
  effect, 24
  state, 24
pure and reversible simulation, 170
purification, 51, 136
  axiom, 171
  in philosophy, 7
  of deterministic transformations, 182
  of general tests, 183
purifying system, 51
purity of state
  criterion, 81

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE
Cambridge University Press
978-1-107-04342-8 — Quantum Theory from First Principles
Giacomo Mauro D'Ariano , Giulio Chiribella , Paolo Perinotti
Index
More Information

PVM, 19
  infinite dimension, 74

QBism, 29
quantum channel, 37, 38, 56
quantum combs, 76
quantum effect, 17
quantum instrument, 46, 146
  infinite dimension, 75
quantum non-locality, 156
quantum operation, 35, 37, 38
quantum roulette, 83
quantum state, 16
  marginal, 20
quantum tomography, 75
qubit, 18
quorum of observables, 28

rank of a map, 42
ray
  extremal, 22
  in a convex cone, 22
  through a point of a convex cone, 22
real quantum theory, 164
reductionism
  of quantum theory, 159
reference system, 51
refinement, 22, 120
  convex, 23
refinement set, 23, 120
  renormalized, 147
renormalized refinement set, 147
repeatable instrument, 46
reversible
  computation, 170
  transformation, 44
roulette, quantum, 83
RefSet, 23
RefSet_1, 23

Schmidt
  form, 40
  number, 40
Schrödinger
  cat paradox, 61
  equation, 84
  picture, 37
self-dual theory, 81
separable
  effect, 30
  Hilbert space, 74
  state, 30, 158
separating, 25, 27
separating set, 161
sequential composition of tests, 113
shift operator, 74
shift-and-multiply
  basis, 41
  group, 81
SIC POVM, 29
simplex, 49
simplicial theory, 49
simulation of randomized algorithms, 170
singlet state, 31
singular value decomposition, 40, 79
singular values, 79
size of a system, 117
slice, 115, 116
Span, 15
Span_+, 27
spectral measure, 75
$\mathsf{S}_s(\mathcal{H})$, 14
state, 12, 115
  basic notion, 12
  completely mixed, 34, 54, 132
  conditional, 38
  deterministic, 14
  internal, 120, 132
  isomorphism with transformations, 182
  local, 27
  mixed, 120
  orthogonal, 225
  pure, 120
  separating, 25
  tomography of, 28
  vector, 25
state identification, 229
state tomography, 28
steering, 175
  of ensembles, 52
  state, 52–54
Stinespring theorem, 56
stochastic vectors, 49
$\mathsf{St}(A)$, 12
$\mathsf{St}_1(A)$, 14
sub-stochastic vectors, 49
sub-unital map, 37
superposition principle, 25
Supp, 19
swap operator, 32
system, 12, 111
  composite, 14
  independent, 115
  input, 111
  multipartite, 14
  operationally equivalent, 112
  output, 111
  trivial, 112

teleportation, 63, 178
  quantum, 63
teleportation tensor, 64

© in this web service Cambridge University Press www.cambridge.org

CAMBRIDGE

Cambridge University Press
978-1-107-04342-8 — Quantum Theory from First Principles
Giacomo Mauro D'Ariano , Giulio Chiribella , Paolo Perinotti
Index
More Information

test, 12, 46, 111
  coarse-grained, 119
  identity, 113
  informationally complete, 147
  non-disturbing, 54
  observation, 12
  preparation, 12
tomography
  ancilla-assisted, 54
  of effects, 30
  of states, 28
  of transformations, 45, 54
trace-decreasing
  map, 37
trace-non-increasing map, 36, 37
trace-norm, 122
$\mathsf{Transf}(\mathsf{A}\to\mathsf{B})$, 12
$\mathsf{Transf}_1(\mathsf{A}\to\mathsf{B})$, 14
transformation, 12, 115
  atomic, 120
  equivalence, 115
  reversible, 44, 119
transposed map, 31
transposition
  map, 37
  of operator, 31
  partial, 31
trivial system, 112, 113
twirling channel, 173

unital map, 37
unitary transformation, 42
universal processor, 209

Vec, 39
von Neumann
  cut, 181
  observable, 19
  observation test, 146
von Neumann–Lüders' instrument, 46

Werner state, 32
Wigner's friend chain, 62

Yang–Baxter identity, 113

© in this web service Cambridge University Press www.cambridge.org