Index

A
Anti-realism
and QBism, 116, 119
operationalism, 30, 41, 85, 182
A priori vs a posteriori knowledge, 61
Aristotle, 73, 84

B
Beckenstein, J., 103
Bell experiment, 8
Boltzmann, L., 76, 79, 85, 86
Breit, G., 181

C
Cantor set, 18
Causality, 5, 19
locality, 9
retro-causality, 89
Church-Turing thesis, 9
Comprehensibility, 25
principle of, 8, 16
Computation, 12
definition, 10
models of, 10
problems of, 10
quantum bit, 107
quantum theory of, 103

D
Darwin, C., 97
Dedekind cut, 18
Determinism, 4, 5, 120
Distinguishability, 104, 105, 107, 108

E
Earman, J., 75, 77
Eddington, A.S.
astrophysics, 40
constants of nature, 49, 50
constructor theory of information, 110
definition of universe, 29
development of mathematics, 18
fine-structure constant, 48, 50
foundation of science, 18
idealism, 41
information, 43
laws of physics, 46, 54
limits of knowledge, 35, 38, 44
natural theology, 38
on relativity theory, 80
on thermodynamics, 80
pacifism, 39
reception, 55
relativity theory, 46, 51
selective subjectivism, 41, 54
spiritualism, 35, 36, 40–42, 54
the mind and consciousness, 46
time, 74, 76, 79–81, 87, 90
Einstein, A., 3, 4, 19, 39, 41, 43, 106, 118, 181
Electromagnetism, 21, 183
Electron
influence, 183, 184, 191, 193
interaction, 183
model, 182–187, 190–193, 196
observer dependency, 183
properties, 182–184, 191
Ellis, G., 74
Energy
conservation of, 105
Entropy, see thermodynamics, see time
  definition, 86
  realisability, 82

F
Faraday, M., 37
Feynman, R., 183
Finetti, B., 124

G
Galileo, 3
Gödel, K., 14, 28, 30, 31
Gold, T., 77

H
Hawking, S.W., 78
Heisenberg limit, 27

I
Information
  and Eddington, 43
  and epistemology, 43
  as an abstraction, 103
  as discourse, 103
  attributes, 43, 108
  constructor theory of, 103, 105–108, 110
  Fisher, 27
  media, 108
  problems associated with, 103
  quantum, 105, 109, 110
  qubit, 169, 170
  super-information media, 109, 110
  variables, 108
Instrumentalism
  and QBism, 115, 116, 127
  quantum mechanics, 114
Interoperability, 103, 104, 108
it from bit, 9, 13, 74, 103, 105

K
Kuhn, T., 20, 22

L
Landsberg, P., 80, 82
Laws of physics
  and computation, 9, 10
  as epistemologically limiting, 2
  constructed, 53, 55

immutability of, 4, 9
in other universes, 17
information, 103
Maxwell, J.C., 37
origin, 41
regularities in, 104
relation to mathematics, 11
relational, 2, 19, 20
speed of light, 3
time symmetry, 80
universal, 2
variable, 19
Leibniz, G.W., 168
Locality, 4, 106
  non-realism, 5

M
Mathematics
  and physical structures, 18
  formalism, 2, 11, 13–16
  in a nearly empty universe, 17
  merger with physics, 53
  physical meaning, 23
  Platonism, 11, 14, 15, 27
  relation to laws of physics, 11
Measurement, 24–26, 41, 42, 92
  and epistemology, 181
  of time, 73
  quantum, 121, 122
Milne, E.A., 53

N
Natural theology, 37
Non-realism
  and QBism, 115, 117, 119, 124

O
Observables
  partial versus complete, 60

P
Pearson, K., 41
Penrose, R., 168
Plato, 73, 84
Post-modernism, 2

Q
Quantum mechanics
  Bell theorem, 121
Born rule, 116, 119, 127
conceptual problems, 167, 182
Copenhagen interpretation, 120
electron model, 182, 184, 185, 187, 190–193, 196
indeterminism, 37, 41
instrumentalism, 116
measurement, 121, 122, 168
probabilities, 167
QBism, 113, 116–128
relativistic, 182
Specker theorem, 121
standard quantum limit, 27
unification with relativity theory, 47, 195

R
Randomness
and quantum mechanics, 168

Realism
and QBism, 116, 117, 119, 124
compatibility with quantum theory, 6
locality, 4, 8
participatory realism, 116, 125, 126
structural realism, 119

Reality
relational laws of, 2
measurement, 42, 121
objective, 2–4, 9, 23, 29, 118
subjective, 2–4, 29, 118

Relativity theory, 11
history of, 2
implies objective reality, 4
principle of, 3
special, 3, 74, 182
spiritualism, 42
twin paradox, 3
unification with quantum mechanics, 47

Representable number, 12
Resource theories, 136
Russell, B., 41

S
Schrödinger, E., 6, 92, 119, 181
Science
and observability, 28
and religion, 35–38, 42, 44
limits of, 24, 31, 35, 38, 44
Shannon, C.E., 104
Shot-noise limit, 27
Space-time
gravity, 30
in an empty universe, 16
mathematics of, 186
models, 75, 77
Speed of light, 3
variable, 19
Standard quantum limit, 27

T
Tegmark, M.E., 14, 15
Testability, 107

Thermodynamics
and temporal asymmetry, 75
and the arrow of time, 77, 79, 80, 90
as a model for information theory, 104
Kelvin, 37
Maxwell’s demon, 85
thermodynamic resource theories, 135
testability, 136

Time
and entropy, 75–77, 79, 80, 85, 86, 90
anisotropy, 74
arrow of, 74, 76, 77, 80–82, 84–89, 93, 95
cosmic, 74, 75, 89, 90, 92, 94, 97
local, 74–76, 79, 89, 90, 97
master, 90, 97
radiative, 97
thermodynamic, 97
direction of, 74
measuring, 73
nature of, 73
physical vs phenomenal, 81
reversibility argument, 80, 81, 84, 86
topology, 75

U
Universe
big bang, 75, 77, 78, 93, 94
big chill, 75, 78, 86, 93, 94
big crunch, 75, 77, 78
computational, 11
de Sitter, 16, 17
definition, 28, 29
empty, 16
expansion of, 80, 81
fate, 75
Gödel-type, 75, 76, 90
Gold model, 78, 84, 86–89
growing block, 79
heat death, 75, 76, 79, 88
mathematical universe hypothesis, 14
models, 77
multiverse, 14, 28
observable, 186
primitives, 16
unobservable, 186

W
Weaver, W., 105

Weyl curvature hypothesis, 93–95
Wheeler, J.A., 11–13, 15, 29, 74, 103, 105, 167, 183
QBism, 113, 121
Whittaker, E., 59