

# Index

## B

- Bell inequality, 24
  - connection to entanglement, 26
- Bell states, 24
- Bloch sphere, 2, 12

## C

- complete positivity, 51
- cryptology
  - key, 84
  - key distribution, 84
  - one-time pad, 84

## D

- decoherence, 133
- decoherence-free subspace, 146
- dense coding, 27
- density matrix, 9
  - ensemble, 9
  - pure state decomposition, 14
  - subsystem, 10, 17
- depolarizing channel, 54
- detection operators, 64, 65
- Deutsch algorithm, 5

## E

- ebit, 33
- entangled state, 23
- entanglement distillation, 33
  - bound entanglement, 41
  - Procrustean method, 34
- entanglement measure, 35
  - concurrence, 42
  - mixed states, 40

- properties, 35
  - von Neumann entropy, 35
- entanglement of formation, 33
- entanglement tests, 28
  - continuous variables, 30
  - entanglement witness, 30
  - positive partial transpose condition, 28
  - range criterion, 41

## H

- hidden variables, 24

## K

- Kraus representation, 50
- properties, 53

## L

- linear code, 141
  - dual code, 142
  - generator matrix, 141
  - parity check matrix, 142
- LOCC (local operations and classical communication), 33

## M

- maximally entangled state, 23
- measurement postulates, 62
  - generalized form, 64
- mixed state, 11

## N

- no-cloning theorem, 55
- superluminal signaling, 56

**P**

pointer variable, 60  
 POVM, 63, 64  
   minimum-error discrimination, 77  
   Neumark's theorem, 66  
   unambiguous discrimination, 74  
 pure state, 11  
 purification, 19

**Q**

quantum algorithms  
   Bernstein-Vazirani algorithm, 95  
   Deutsch-Jozsa algorithm, 93  
   Grover algorithm, 96  
   phase estimation, 102  
   Simon's algorithm, 101  
 quantum circuit, 4  
 quantum cloning machine, 118  
   fidelity, 119  
 quantum codes, 133  
   correction condition, 138  
   CSS codes, 141  
   degenerate, 137  
   errors, 134  
   nondegenerate, 137  
   Shor code, 134  
   Steane code, 145  
 quantum cryptography, 83  
   B92 protocol, 85  
   BB84 protocol, 86  
   E91 protocol, 88  
 quantum gates, 3  
   Controlled-NOT gate, 4  
   f-controlled-NOT gate, 5, 94  
   Hadamard gate, 3, 93  
   NOT gate, 3  
   quantum NOT gate, 3  
 quantum key distribution, 84  
 quantum machines, 117  
   programmable  
     no-go theorem, 120

    probabilistic, 123  
     state discriminator, 125  
 quantum map, 49  
 quantum secret sharing, 89  
 quantum walk  
   search  
     edge, 110  
     vertex, 108  
   star graph, 107  
 quantum walks, 105  
 qubit, 1, 12

**R**

relative entropy, 36

**S**

Schmidt decomposition, 17  
 separable state, 23  
 standard quantum limit, 60  
 state discrimination, 70  
   minimum-error, 75, 86  
     error probability, 78  
   programmable, 125  
   unambiguous, 71, 85, 89  
     failure probability, 74  
 superoperator, 50  
 superposition, 1, 6

**T**

teleportation, 27  
 trine states, 68  
 Tsirelson inequality, 26

**U**

U-NOT gate, 117  
   fidelity, 119  
 unextendible product basis, 41