

## Index

### **a**

- acoustic resonator 178
- AlAs 108
- AlGaAs 109
- Allan variance 24
- antibunching of photons 192, 194, 198
- arrays of QHE resistors 123
- avalanche photodiodes (APD) 199

### **b**

- band structure 104
- BCS theory 62
- black body radiometer 180
- Bloch oscillation 148
- Bordé–Ramsey atom interferometry 38, 44
- bunching of photons 192

### **c**

- chemical potential 134
- Clausius–Mosotti relation 177
- clock comparison 25, 51
- coherence properties of light 191
- conductivity tensor 115
- constant volume gas thermometer (CVGT) 176
- Cooper pair 62
- coordinated universal time (UTC) 11
- coplanar waveguides 70
- correlation function 191
  - first-order 191
  - second-order 191, 195, 198
- cotunneling 139
- Coulomb blockade 132, 134, 135, 185
- Coulomb energy 134
- cryogenic current comparator 94, 123, 150
- cryogenic radiometer 180
- Cs-atomic clock 11
- Cs-fountain clock 32

current biasing of SQUID 91

- current, critical 64, 70
- cyclotron frequency 104

### **d**

- defining constants 21, 157
- density of states 105–107
- deterministic single-photon source 194
- disorder 118
- doping 112
- Doppler effect 12, 25, 26, 37, 181

### **e**

- edge channel model 118
- effective electron mass 104
- Einstein’s equivalence principle (EEP) 49, 155
- electrochemical potential 134
- electron shelving technique 44
- electrostatic potential 134
- energy dispersion 104, 106
- ephemeris second 11
- Er-doped fiber laser 42
- error accounting 149, 150
- exciton 198

### **f**

- filling factor 116, 117
- fine-structure constant 49, 124
- Fizeau interferometer 160
- flux quantum 64, 65, 77, 81, 117
- flux transformer 92
- flux-locked loop 92, 200
- fractional quantum Hall effect 119
- frequency chain 39
- frequency stability 23
- frequency, characteristic 69, 76, 77

***g***

- GaAs 108
- GaAs/AlGaAs heterostructure 109, 121, 142, 196
- gauge block 15
- General Conference of Weights and Measures 1
- graphene 121, 145
- guidelines for QHE metrology 121
- GUM 5

***h***

- Hall
  - coefficient 115
  - field 114
  - resistance 115
  - voltage 114
- Hall bar 122
- Hanbury Brown and Twiss interferometer 192
- Heisenberg uncertainty relation 6, 12, 133
- heterojunction 108, 113
- high-temperature superconductors 62
- highly enriched  $^{28}\text{Si}$  164
- hydrogen maser 35

***i***

- impedance metrology based on the QHE 125
- international kilogram prototype 15, 155, 169
- international temperature scale (ITS) 18, 186
- ion accumulation experiment 158
- isotope dilution mass spectrometry 164

***j***

- Johnson noise thermometry 81, 183
- Josephson arbitrary waveform synthesizer 78
- Josephson constant 64, 149, 166
- Josephson equations 64
- Josephson impedance bridge 80
- Josephson junction 63
  - overdamped 67
  - SINIS 68, 69, 74, 75
  - SIS 68, 69
  - SNS 68, 69, 74, 75, 77
  - underdamped 67
- Joule balance 168

***k***

- Kilogramme des Archives 155

***l***

- Lamb–Dicke regime 31
- Landau level 105, 107
- Landauer–Büttiker formalism 118
- leap second 11
- linewidth, homogeneous 26
- localized electronic states 118
- London penetration depth 83

***m***

- magic wavelength 45
- magnetic flux quantization 84
- magnetic moment, measurement of 94
- magnetically shielded room 97
- magneto-optical trap 27
- magneto-transport 103
- magnetocardiography 96
- magnetencephalography 96
- magnetometer 90, 92
- McCumber parameter 67
- measurement uncertainty 5
- Meissner–Ochsenfeld effect 82
- metal organic chemical vapor deposition 110
- metal organic vapor phase epitaxy 110
- metal-oxide-semiconductor field-effect transistor (MOSFET) 103, 108, 121, 145
- Meter Convention 1
- Mètre des Archives 1
- metrology 1
- microstrip line 70
- mobility of electrons 112
- mode-locking 39
- molar mass of Si 158, 164
- molar mass unit 169
- molecular beam epitaxy 110

***n***

- neutral atom clocks 43
- noise
  - 1/f 9
  - quantum 8
  - shot 9
  - thermal 8
- noise power spectral density 7
- nomenclature of atomic states 10
- nuclear magnetic resonance 98
- Nyquist relation 8, 183

***o***

- octupole transition 46
- optical lattice clock 45
- optical molasses 26

**p**

- Paul trap 30  
 Penning trap 30  
 phase relaxation time 36  
 photomultiplier tubes (PMT) 199  
 photon-assisted tunneling 141  
 Planck law 180  
 probabilistic single photon source 194

**q**

- quantization energy 106  
 quantized current 131  
 quantized voltage noise sources 183  
 quantum dot, self-assembled 197  
 quantum interference 87, 89  
 quantum jump fluorescence detection 46  
 quantum logic spectroscopy 47  
 quantum optics 191  
 quantum phase slip 148  
 quantum voltmeter 80  
 quantum well 106, 111  
 quantum-based electrical power standard 80

**r**

- R-pump 141  
 Rabbi frequency 13  
 Ramsey technique 12, 32  
 RCSJ model 66, 91  
 realization of the SI ohm 120  
 recoil limit 29  
 recoil momentum 26, 38  
 representation of the ohm 122  
 representation of the volt 73  
 resistance bridge 95  
 resistance metrology 119  
 resistivity 115  
 Rydberg frequency 50

**s**

- saturated absorption spectroscopy 37  
 scaling of resistance values 123  
 Schrödinger equation 63  
 Shapiro steps 65  
 Si single crystal 158  
 single ion frequency standards 46  
 single-electron  
   – electrometer 136  
   – pump 137, 139, 143  
   – quantum box 132  
   – transistor 133  
   – turnstile 138, 146  
 single-photon emitter 193

**SINIS structure**

- 146  
 Sisyphus cooling 28  
 size quantization 104, 106, 141, 196  
 spectral radiance 180  
 speed of sound 178

**superconducting quantum interference device (SQUID)**

- 81  
 SQUID gradiometer  
   – first-order 93  
   – second-order 94  
 stability diagramm  
   – SET pump 138  
   – SET transistor 136  
 Stefan–Boltzmann law 180  
 superconducting magnetic levitation 157  
 superconducting quantized charge pump 147  
 superconducting sluice 147  
 superconducting transition edge sensor 199  
 supercontinuum 42  
 supercurrent 63  
 sympathetic cooling 48  
 synchrotron radiation 180, 202

**t**

- thermal converter 73, 80, 81  
 thermal state equation 176  
 titanium–sapphire laser 41  
 total radiance 180  
 transfer error 139, 145  
 triple point of water 18, 175  
 tunnel element 132  
 two-dimensional electron gas (2DEG) 103, 112, 142, 196

**u**

- universality of the QHE 121

**v**

- virial expansion 176  
 voltage balance 72, 157  
 voltage, characteristic 70, 75  
 von Klitzing constant 117, 133, 149, 166

**x**

- x-ray crystal density (XRCD) 158  
 x-ray interferometer 162

**z**

- Zeeman energy 105  
 Zeeman slower 26

