

INDEX

- absorption coefficient, 131
- absorption saturation, 189
- acceptor, 47
 - in energy transfer, 211
- Ag nanoparticles, 173
 - extinction spectra, 131
 - fluorescence enhancement, 176
 - nonradiative decay enhancement, 174
- AIAs
 - parameters, 38
- AlInN VCSEL, 292
- AlN
 - parameters, 38
 - solid solutions, 48
- AIP
 - parameters, 38
- antenna, 181
- antibody, 393
- antigens, 393
- anti-Stokes luminescence, 234
- art pigments
 - microcrystallites, 397
- atomic energy unit, 25
- atomic length unit, 25
- Au nanorods
 - extinction spectra, 131
- Auger recombination, 219, 238
- Avogadro's number, 214

- ballistic transport, 57
- band gap, 28
 - correlation with elemental composition, 38
 - photonic, 105
- band gap energy, xii, 33
- band structure, 33
- bandwidth limited pulses, 316
- Bessel functions
 - roots, 24
 - spherical, 23
- black body radiation, 149
- Bloch theorem, 28
- Bloch waves, 27
 - in optics, 104

- Bohr radius, 26
 - for excitons, 41
- Boltzmann constant, 33
- Boltzmann factor, 33
- Boltzmann relation, 148
- Bose–Einstein statistic, 46
- boson, 46, 53
- bowtie antenna, 135
- Bragg mirror, 111
- Brewster angle, 103, 415
- Brewster law, 103
- Brillouin zones
 - in optics, 105
- Bruggeman formula, 110
- Burstein–Moss shift, 47

- C (diamond)
 - parameters, 38
- carbon dots, 381
- carbon quantum dots, 245
- Cd-based quantum dots, 380
- CdS
 - parameters, 38
- CdS nanocrystals
 - quantum size effect, 80
- CdSe
 - band structure, 33
 - parameters, 38
 - quantum dots, 236
- CdSe nanocrystals
 - quantum size effect, 80
- CdTe
 - parameters, 38
- CdTe nanocrystals
 - quantum size effect, 80
- CdTe quantum dot
 - luminescence, 84
- Ce-doped YAG
 - luminescence, 241
- chameleon, 120
- chromaticity coordinates, 232
- chromaticity diagram, 232
- cluster, 73

- colloidal crystals
 - in optics, 120
- colloidal LED, 260
- colloidal optoelectronics, 380
- colloidal quantum dot LED, 383
- colloidal quantum dot solar cells efficiency, 376
- color space, 231
- compact fluorescent lamp (CFL)
 - spectrum, 150
- conductance quantum, 57
- conduction band, 32
- copper indium sulfide quantum dots, 245
- core-shell quantum dot, 84
- correlated color temperature (CCT), 231
- Coulomb potential, 25
- CuBr
 - parameters, 38
- CuCl
 - parameters, 38
- de Broglie wavelength, 10
 - for electrons in metal, 61
 - for electrons in semiconductors, 58
- degenerate states, 15
- density of states, 52
 - effects in optics, 160
 - for photons, 154
- Dexter mechanism, 212
- diamond, 32
 - parameters, 38
- dielectric, 32
- dielectric constant, xiii, 42
- dielectric susceptibility, 354
- dipole-dipole interactions, 212
- direct-gap semiconductors, 33
- directional coupler, 346
- dispersion law, 93
- distributed Bragg reflector (DBR), 111, 128
- DNA origami, 420
- donor, 46
 - in energy transfer, 211
- down-conversion, 234
- DWDM, 294
- dynamical Burstein-Moss shift, 198
- edge-emitting (Fabry-Pérot) laser, 279
- effective mass, 31
- effective medium approach, 129
- Einstein coefficients, 147
- electroluminescence, 150
 - plasmonic enhancement, 175
- electron-hole pair, 36
- electron-hole plasma, 198
- energy bands, 28
- energy transfer
 - resonance, 212
- Eu-doped phosphor, 243
- excitation spectrum, 237
- exciton, 41
 - Bohr radius, 41
 - diffusion, 219
 - dissociation, 219
 - exciton-exciton annihilation, 219
 - in a quantum dot, 83
 - Rydberg energy, xiii, 41
- external differential efficiency, 282
- external quantum efficiency, 247
- extinction coefficient, 131
- extraction efficiency, 282
- Fabry-Pérot resonator, 126
- Fermi energy, 46
 - for electrons in metal, 61
- Fermi golden rule, 56, 156
- Fermi level, 46
- Fermi-Dirac statistic, 46
- fermion, 46, 53
- fluorescence, 153
- fluorescence line narrowing, 85
- Fock states, 410
- Förster mechanism, 212
- Förster radius, 214
- Förster resonance energy transfer, 215
- Fresnel formulas, 102
- fullerene, 73
- GaAs
 - band structure, 33
 - parameters, 38
 - quantum well lasers, 279
- GaN
 - absorption spectrum, 45
 - band structure, 33
 - parameters, 38
 - quantum well lasers, 279
 - solid solutions, 48
- GaN photonics, 35
- GaN quantum wells
 - LED, 245
- GaP
 - band structure, 33
 - parameters, 38

- Ge
 band structure, 33
 parameters, 38
 generator, 192
 Grätzel cells, 372
 Green's function, 162
- Hamiltonian, 13
 harmonic oscillator, 16
 Helmholtz equation, 97
 versus Schrödinger equation, 140
 heterojunction laser, 199
 heterostructure, 61
 heterotransfer, 211
 HgTe
 parameters, 38
 HgTe quantum dot
 luminescence, 84
 HgTe quantum dots
 photodetector, 388
 homotransfer, 211
- immunoassay, 393
 impedance, 134
 InAs
 parameters, 294
 indirect-gap semiconductors, 34
 inhomogeneous broadening of optical spectrum, 85
 injection efficiency, 280
 InN
 parameters, 38
 solid solutions, 48
 InP
 quantum dots, 240, 256
 quantum well laser, 279
 InSb
 parameters, 38
 internal efficiency, 280
 internal quantum efficiency (IQE), 247
 Ioffe–Regel criterion, 138
- Kerr nonlinearity, 355
 Kramers–Kronig relations, 348
- Lambert's law, 182
 LAN, 294
 lanthanides, 241
 laser, 190
 laser bar, 279
 laser pointer, 194
 lasers, 192
 lattice
 body-centered cubic, 31
 face-centered cubic, 31
 hexagonal, 31
 simple cubic, 31
 lattice constant
 III–V compounds, 61
 in semiconductors, 58
 LCD screen, 243
 LED, 150
 lifetime, 151
 Li-Fi (Light Fidelity), 271
 light extraction efficiency, 247
 local density of states (LDOS), 158
 in optics, 181
 local electric field enhancement, 133
 in an Au antenna, 135
 localization of waves, 138
 lumen, 231
 luminance efficacy of optical radiation (LER), 231
 luminescence, 149
 luminescent lamp, 150
 luminophore, 234
- Mach–Zehnder interferometer, 347
 magic numbers, 73
 Maxwell's equations, 95
 mean free path, 136
 mercury, 150
 metal, 32
 metals
 optical parameters, 124
 microcavity, 128
 mirror
 dielectric, 109
 metallic, 122
 MOCVD, 63
 in LED fabrication, 246
 modal gain, 281
 coefficient, 281
 mode, 52
 mode locking, 195
 in semiconductor lasers, 329
 molecular beam epitaxy (MBE), 200
 moth-eye antireflection design, 374
 MOVPE, 63
 multi-exciton generation (MEG), 365
 multilayer stack, 104

- nanocrystal, 73
- nanoplasmonics, 129
- nanorods, 72
- nanowire
 - energy transfer, 220
- opal, 117
- optical analogies to quantum phenomena, 140
- optical antenna, 134
- optical gain
 - in semiconductors, 198
- Pauli's exclusion principle, 32
- Pb-based quantum dots, 380
- PbS
 - parameters, 38
- PbS colloidal quantum dot
 - in solar cells, 369
- PbS-doped glasses, 318
- PbSe
 - parameters, 38
- PbSe quantum dots
 - photodetector, 387
- periodic medium in optics, 104
- perovskite nanocrystals, 381
- perovskite quantum dots, 245
- pH detector, 398
- phosphor, 235
- phosphorescence, 153
- photodetector characteristics, 387
- photoluminescence, 150
- photoluminescence kinetic
 - CdSe quantum dots, 151
 - Eu ions, 151
- photon density of states (DOS), 154
- photon lifetime in a cavity, 283
- photonic band structure, 112
- photonic crystal, 111
 - waveguides, 121
- photonic dots, 128
- photopic sensitivity, 229
- Planck constant, 10
- Planck formula, 148
- plasma frequency, 122
- plasmonic sensors, 131
- plasmonics
 - for optoelectronic devices, 388
 - in LEDs, 265
- Poisson distribution, 408
- polarization, 101
- Purcell effect, 157
- Purcell factor, 157
- Q*-factor, 127
- Q-switching, 195
- quantum confinement, 58
- quantum dot, 59, 74
 - energy transfer, 220
 - in display devices, 243
- quantum dot solids, 87
- quantum number
 - magnetic, 24
 - orbital, 24
 - principal, 24, 26
 - radial, 26
- quantum well, 59, 63
 - energy transfer, 220
 - spherical, 22
- quantum wire, 59, 70
- quantum yield, 151
- quarter-wave stack, 106
- quasi-momentum, 28
- quasiparticles, 35
- Raman labels, 394
- Raman scattering, 160
- random lasing, 140
- Rayleigh scattering, 160
- recombination, 37
- reflection
 - total, 100
 - total, frustrated, 126
- reflection coefficient, 100
 - GaN/air interface, 100
 - Si/air interface, 100
- refractive index, 93
 - complex, 130
 - sensing, 399
 - of solids, 94
- rocksalt, 32
- Rydberg energy, 26
- Saha equation, 43, 57
- saturable absorber, 313
- scattering, 56
 - in optics, 137
- Schrödinger equation, 13
- scotopic-to-photopic ratio, 252
- semiconductor disk laser, 322
- semiconductor doped glasses, 317
- semiconductor materials in photonics, 34
- semiconductors, 33
- SERS, 395
 - for microcrystallites, 396
 - ZnO nanocrystals, 395

- SESAM, 195
- Shockley–Queisser limit, 365
- Si
 - band structure, 33
- Si electro-optical modulator, 353
- SiC
 - parameters, 38
- silicon photonics, 346
- silicon-on-insulator (SOI), 346
- skin effect, 124
- slow light, 357
- Snell's law, 100
- solar radiation spectrum, 150
- solid solution
 - GaN, InN, AlN, 48
- spectral hole burning, 85
- spherical coordinates, 22
- spontaneous transitions, 147
- standard luminosity function, 230
- stimulated transitions, 147
- Stokes shift, 234
- stop band, 105
- superlattice, 19, 285

- thermal radiation, 148
- threshold current density, 281
- TNT (trinitrotoluene) detector, 396, 397
- transmission coefficient, 131
- transparency current, 280
- tumor markers, 393
- tunneling, 19
 - in optics, 126
 - resonant, 285
 - resonant in optics, 21, 105

- Urbach–Martienssen rule, 46

- valence band, 32
- VCSEL, 202
- velocity, 92
 - phase, 93
- vision, 136

- wall-plug efficiency (WPE), 248
- wave equation, 96
- wave function, 11
- wave number, 92
- wave vector, 92
- waveguide, 101
- wavelength, 92
- wavelength in a medium, 97
- whispering gallery modes, 128
- Wigner spin, 219
- wurtzite, 32

- Yagi–Uda antenna, 135

- zinc blende, 32
- ZnO
 - parameters, 38
- ZnO nanocrystals
 - quantum size effect, 80
- ZnS
 - parameters, 38
- ZnSe
 - absorption spectrum, 45
 - parameters, 38
- ZnSe nanocrystals
 - quantum size effect, 80
- ZnSe quantum dot
 - luminescence, 84
- ZnTe
 - parameters, 38