

Index

- Aberrations, 8, 19
- Absorption, 20
- Afocal telescope, 14-16, 87-88
- Angular magnification, 14
- Anode, 78-79
- Antireflection coating, 20-21
- Aperture stop, 8, 9, 16
- Area-solid-angle product, 38, 42-43
- Astigmatism, 18
- Axial ray, 8, 13

- Back focal distance, 12
- Bandwidth, 61-62
- Beam waist, 86-89
- Bessel function, 17
- Blackbody, 48-52, 59, 84-85
- Bolometric detector, 79-80
- Boltzmann's constant, 31, 57

- Cassegrain, 14-15
- Cathode, 78-79
- Cavity radiation, 48
- Celsius, 31
- Chief ray, 9, 10, 13
- Chromatic aberration, 18
- Coma, 18
- Convolution, 23, 25
- Cooling requirements, 57, 58, 80
- Cosine-to-the-fourth falloff, 41-43
- Cutoff wavelength, 56-58, 72-73, 77-78

- D-star, 71-72
- Dark current, 57, 73
- Diffraction, 16-19, 29-31, 44-45, 83-84, 86, 89
- Dispersion, 19
- Distortion, 18
- Divergence angle, of laser beam, 83, 88-89
- Duty cycle, 90
- Dynode, 79

- Electromagnetic spectrum, 1
- Emissivity, 51-53

- Energy-based units, 33-34, 58-59
- Energy gap, 56-58, 73, 77-78
- Exitance, 33-35, 39-40, 47-52
- Extrinsic photoconductor, 77
- Eye, spectral response, 1

- Fahrenheit, 31
- Field curvature, 18
- Field of view, 9-11, 16, 18-19, 42
- Field stop, 9, 10, 44
- Flux, 33
- Flux gathering capability, 38, 42-43
- Flux transfer, 11, 18, 31, 33-45
- F-number, 8-9, 11, 16-19, 29, 42
- Focal length, 4-5, 8, 12
- Focal point, 4-5, 12
- Footprint, detector, 10
- Fourier transform, 17, 23
- Frequency response, detector, 60-62
- Fresnel equations, 19-20
- Full-width-at-half-maximum, of laser beam, 86

- Galilean telescope, 14-15, 87-88
- Gaussian beam, 85-90
- Generation-recombination noise, 63, 67, 77
- Graphical raytrace rules, 4-5, 10
- Graybody, 52

- Image, 3-4
- Image distance, 6, 8, 18, 29
- Image-forming system, flux transfer, 42-43
- Image plane, 4, 10
- Image quality, 9, 11, 16-19, 23, 28
- Imaging equations, 6
- Impulse response, spatial, 23, 25
- Impulse response, temporal, 60-62
- In-band calculation, 47-49
- Index of refraction, 2, 19, 20
- Infinity, point source at, 3, 6, 8
- Intensity, 33, 35-36

Interference, 21, 31
 Intrinsic photoconductor, 77
 Irradiance, 33, 34, 36, 42-44, 84-85, 87, 90
 Johnson noise, 63, 67-69
 Kelvin, 31
 Keplerian telescope, 14, 87-88
 Knife-edge, 91-93
 Laser, spectral flux, 48, 59, 85
 Lambertian source, 37, 39-40, 49
 Magnification, 6, 7, 10-12, 14, 16
 Marginal ray, 8-9
 Modulation depth, 25-26
 Modulation transfer function, 25-30
 Noise-equivalent bandwidth, 60-62
 Noise-equivalent power, 69-72, 76-77, 79-80
 Object distance, 6, 8, 18, 29
 Object plane, 4, 10
 One-over-f noise, 63, 69, 77
 Open-circuit voltage, 74
 Operational amplifier, 74-76
 Optic axis, 3-4, 6-7
 Optical transfer function, 25
 Paraxial approximation, 3, 7, 16, 18, 31, 38, 43
 Phase transfer function, 25
 Photoelectric effect, 78-79
 Photoemissive detector, 78-79
 Photomultiplier tube, 79
 Photon detector, 55-59, 72
 Photon energy, 2, 34, 56
 Photon-based units, 33-34, 58, 59
 Photoconductive detector, 72, 77-78
 Photovoltaic detector, 72-76
 Planck equation, 49-51
 Planck's constant, 2, 31
 Point source, 2, 3, 6, 18, 35-36, 44-45
 Power, 33, 90
 Power spectral density, 63
 Principal plane, 12-13, 16
 Projected area, 36-37
 Pyroelectric detector, 80-82
 Quadrature addition of noise, 62, 63
 Quantum efficiency, 74
 Radiance, 33, 36-40, 47
 Radiometric units, 33
 Rankine, 31
 Ray, 2-4
 Rayleigh range, 89
 Raytrace rules, graphical, 4-5, 10
 Reflection, 20
 Relay-lens pair, 13
 Resolution, 18, 26-28
 Response speed, detector, 55, 60-62, 75-76, 78-79, 82
 Responsivity, 55-56, 58-59, 70, 82
 Reverse bias, 75
 Root-mean-square, 62
 Schottky-barrier detector, 76-77
 Sensitivity, 55
 Short-circuit current, 74-75
 Shot noise, 57, 63-67, 77, 79
 Signal-to-noise ratio, 55, 63, 65-66, 69-72
 Snell's Law, 5, 19
 Solid angle, 32-33, 35-37
 Spatial frequency, 23-30
 Spectral responsivity, 55-56, 58-59
 Spectral units, 47-48, 50, 59
 Speed of light, 2, 31
 Spherical aberration, 18
 Stefan-Boltzmann constant, 31, 51
 Stefan-Boltzmann Law, 49-51
 Steradian, 32
 Telescope, afocal, 14-16
 Telescope, Galilean, 14-15
 Telescope, Keplerian, 14
 Temperature, 31, 48-49
 Thermal detector, 55-56, 59
 Thin lens, 4-5, 11-13
 Throughput, 38, 42-43
 Transfer function, modulation, 25

Transfer function, temporal, 61-62

Transmission, 20

Trapezoidal integration, 47-49

Units, radiometric 33

Vignetting, 13

Waist, laser beam, 86-89

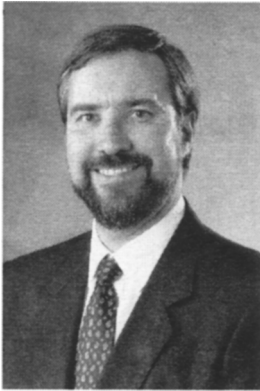
Wavefront, 3, 83

Wavelength, 1-2, 17-18, 47

Wavelength, cutoff, 56-58, 72-73, 77-78

White noise, 64

Wien Displacement Law, 49, 51



Glenn D. Boreman is Professor of Electrical Engineering in the Center for Research & Education in Optics & Lasers (CREOL) at the University of Central Florida. He received a BS from the Institute of Optics, University of Rochester, and a PhD from the Optical Sciences Center, University of Arizona. He is a registered professional engineer, and has held visiting research positions with IT&T, Texas Instruments, US Army Night Vision Lab, US Army Redstone Arsenal, and McDonnell Douglas. He has been a visiting scholar at the Imperial College in London, and the Swiss Federal Institute of Technology (ETH) in Zürich.

Dr. Boreman serves the Optical Society of America as the Editor of the Optical Technology Division of *Applied Optics*.

He also serves on the Board of Directors of SPIE, and is an Associate Editor of the SPIE journal *Optical Engineering*. He is author of the optical-transfer-functions chapter in the *Handbook of Optics*, is coauthor of the graduate textbook *Infrared Detectors and Systems* (John Wiley & Sons, 1996), and has published more than 80 articles in the areas of infrared detectors, statistical optics, and modulation-transfer functions. He received the 1995 Kingslake Medal and Prize from SPIE.