

Index

Numerics

24-bit color 558

A

à trous algorithm 478
aberration 250
aberrations 5
ADU 22, 40
afocal 9
air mass 286
Airy diffraction figure 499
Airy disk 7
 angular diameter of 7
all-sky photometry 279, 289, 296
analog-to-digital unit 40, 44
Ångström, Anders 304
angular 7
angular field of view 25
angular field of view for CCDs 79
angular pixel size for CCDs 79
annulus 274
Anscombe transform 488
anti-blooming gates 21
apparent positions 250
archiving digital information 151
asteroid astrometry 265
astrometric catalogs 249
astrometric position 250
astrometry 221, 249
atmospheric extinction 286
atmospheric turbulence 499
AVI 57

B

back-illuminated CCDs 18
Barlow lens projection 145
Barnard's Star 250
barycenter 216
bas-relief operators 385
Bayer array 20, 558
bias frames 124, 165

binary data array 66
BITPIX (FITS keyword) 61
black body radiation 516
blinking 447
blocking filters 549
blooming trail 21
blue bloat 85
BMP 57
boxcar unsharp mask 390
Bunsen, Robert 303
burst noise 243
Butterworth filter 472
byte order 58

C

calibration
 advanced protocol 123, 158
 basic protocol 123, 157
 errors 199
 bias drift 199
 changing CCD temperature 200
 changing optical configuration 201
 noise 195
 standard protocol 123, 158
camera, digital SLR 128
Canon 10D 557
Canon Digital Rebel 557
Cape Photographic Catalog 251
CCD 14
CCD camera's performance
 charge skipping 228
 conversion factor 228
 dark current 228
 interference 228
 linearity 228
 noise pickup 228
 readout noise 228
 uniformity 228
CCDs
 back-illuminated 18
 frame-transfer 17

Index

- front illuminated 18
 - reflections 104
 - sizes 83
 - centroid determination 216
 - Cepheid variables 296
 - charge skipping 243
 - chrominance 514
 - chrominance component 513
 - clock drive
 - testing 95
 - tuning 95
 - CMOS 14
 - CMY filters 554
 - color
 - wavelengths 515
 - color channel 573
 - color plane 573
 - color space 539
 - comet astrometry 265
 - COMMENT (FITS keyword) 61
 - computer-controlled mountings 93
 - constant sigma scaling 489
 - conversion factor 44
 - convolution 365, 464
 - convolution kernel, properties 375
 - commutivity 376
 - linearity 375
 - separability 377
 - Cooley, P. M. 469
 - coordinate reference frame 251
 - Cousins, Andrew 282
 - cropping 332
 - CRW 57
 - cylinder focusing 103
- D**
- dark current 43, 162
 - determining 247
 - dark frame 46, 170
 - matching 176
 - scalable 175
 - standard 175
 - taking 124
 - dark frames 43
 - Davis, Don 304
 - deconvolution 499
 - deconvolve 368
 - deep-sky imaging
 - guided one-shot imaging 132
 - track-and-stack imaging 132
 - deep-sky objects 130
 - deep-sky targets
 - clusters of galaxies 139
 - comets 140
 - dark nebulae 138
 - galaxies 138
 - globular clusters 136
 - HII regions 136
 - open clusters 135
 - planetary nebulae 136
 - quasars 140
 - reflection nebulae 137
 - defect mapping and correction 203
 - detector 9
 - detector limited 49
 - determining a centroid 216
 - differential photometry 278, 290, 291, 293
 - diffraction grating 305
 - diffraction-limited images 6
 - digital
 - development 422
 - setting circles 93
 - digital number 44
 - digital single-lens-reflex (dSLR) camera 557
 - digital SLR camera 128
 - digital snapshots 131
 - discrete Fourier series 466
 - dispersion 312
 - DN 22
 - dome flats 184
 - do-what-you-can photometry 292, 298
 - drift subtract mode 168
 - dust donuts 102, 107
 - dyadic 480
- E**
- eclipsing binary stars 293
 - edge-detection kernels 385
 - electroluminescence 178
 - electronic transitions 517
 - electrons per ADU 44
 - epoch 250
 - erratic errors 95
 - expectation maximization method 507
 - exponential histogram shaping 363
 - extinction values 532
 - extrafocal star test 107
 - eyepiece projection 144
- F**
- fast Fourier transform 469
 - feature masking 474

- fiber-fed spectrograph 310
- fiber-fed spectrograph images 318
- field flooding 102, 105
- field of view 77
- filter matrix 537
- finder scopes 92
- finders
 - big 92
 - flip-mirror systems 92
 - unity-power 92
- FITS 57, 59
 - Basic FITS 59
 - binary image data 60
 - header 59, 61
 - keyword 61
 - tailer 60
- FITS variants 68
 - nonconforming data arrays 68
 - nonconforming headers 68
 - un-coordinated header and data arrays 68
- FK3 251
- FK4 251
- FK5 251
- flat-field frame 125, 180
 - dome flats 183
 - light-box 183
 - sky flats 184
 - twilight flats 183
- flats 185
- flipping 331
- floating 332
- flopping 331
- focus
 - methods
 - diffraction-spike 120
 - holes-in-a-mask 121
 - longest blooming trail 120
 - number of faint stars 119
 - peak pixel value 119
 - smallest star image 119
- Fourier integral 458
- Fourier series 456
- Fourier transform
 - inverse scaling 463
 - linearity 462
 - symmetry 462
- Fourier, Jean Baptiste Joseph 455
- Fraunhofer, Joseph 303
- free spectral range 312
- front-illuminated CCDs 18
- full width halfmaximum 273
- FWHM 273
- G**
- G2V stars 531
- gain 44
- gamma transfer function 349
- gammatog transfer function 351
- Gaussian
 - histogram 361
 - histogram shaping 362
 - unsharp mask 392
- Gaussian distribution 39, 42
- Gavin, Maurice 304
- geometric transforms
 - cropping 332
 - flipping 331
 - floating 332
 - flopping 331
 - resampling 334
 - rotation 325
 - scaling 328
 - translation 321
- gradient kernels 385
- gratings
 - reflection 305
 - transmission 305
- Guide Star Catalog (GSC)* 251
- guiding methods
 - off-axis 116
- H**
- H II regions 521
- high-pass filters 381
- high-point pixel values 210
- high-resolution images 147
- Hipparchos Catalog 252
- histogram equalization 362
- HISTORY (FITS keyword) 61
- hot pixels 46, 163
- hot spots 102, 103
- how to
 - shoot dome flats 184
 - shoot light-box flats 184
 - shoot sky flats 186
 - shoot twilight flats 185
- how to install *AIP for Windows* 613
- HSL color space 541
- hue 541
- Huggins, William 304
- human color vision 514
- hydrogen hypersensitizing 12

Index

I

- image
 - aspect ratio 23
 - calibration
 - advanced 190
 - basic 187
 - standard 188
 - feature analysis 212
 - histogram 210
 - profiles 220
 - stacking 197
 - times-five rule of thumb 172
- image calibration
 - advanced 441
 - basic 440
 - dark subtraction 436
 - flat-fielding 438
 - standard 441
- image estimation by iteration 501
- image math
 - absolute difference 429
 - addition 425
 - average 432
 - division 429
 - merge 430
 - multiplication 428
 - subtraction 426
- image ranking
 - maximum 435
 - median 433
 - minimum 435
- image registration
 - rotation 444
 - scaling 444
 - translation 443
- impulse function 485
- instrumental zero point 275
- interference filters 549
- interline-transfer CCDs 17
- internal lens reflections 104
- inverse convolution problem 500
- inverse wavelet transform 480
- iterative wavelet noise filter 491

J

- Johnson, Harold 282
- JPEG 57, 59

K

- Kirchhoff, Gustav 303
- Kirsch operators 386
- k-sigma filter 494

L

- Lab color space 544, 575
- Laplacian operator 388
- level 477
- light box 126
- light, definition 1
- light-box flats 184
- linear transfer function 347
- line-detection operators 387
- logarithmic transfer function 350
- low point pixel values 210
- low-level light source (L3S) 229
 - construction 234
- low-pass filters 378
- LRGB imaging 546
- Lucy, L.B. 507
- Lucy-Richardson method 507
- luminance 514, 541

M

- master bias frame 169
- maximum likelihood method 508
- maximum pixel value 208
- mean of the median half 216
- mean pixel value 209, 214
- median pixel value 209, 216
- Menzies, John 282
- Mexican Hat function 477
- milk plastic 126
- minimum pixel value 208, 213
- Morgan, W.W. 282
- morphological operators 413
 - dilation 419
 - erosion 419
 - Frei and Chen 415
 - opening, and closing 419
 - skeleton 418
- multi-luminance) imaging 552
- multiple convolutions 371
- multiple-image processing 663
- multiplicative error 157
- multiresolution support image 490

N

- narrowband color images 553
- native color space 573
- nebulae spectral lines 518
- NEF file format 57
- negative transfer function 352
- Nikon D70 557
- 1/f noise 243
- noise filters 411

- noise pattern 46
- non-linear enhancement
 - extreme value 406
 - local adaptive sharpening 408
- non-linear operators
 - median 399
 - minimum and maximum 398
 - multiplicative rank 403
 - rank-order 401
- normalized master flat frame 567
- Nyquist
 - criterion 144
 - sampling theorem 29
- O**
- objective prism images 314
- objective prism spectrograph 305
- objective prism, ray paths 307
- observational error, analysis 268
- Okano, Kunihiro 422
- oversampling 29
- P**
- Parseval's Theorem 466
- periodic error 94
 - correction (PEC) 97
- photographic emulsions 11
- photometric
 - image profile 224
 - systems 279
- photometry 221, 271
- photon
 - flux 159
 - statistics 194
- photon limited 49
- pinhole camera 2
- pixel 27
 - angular size 27
 - aspect ratio 23
- pixel measurements
 - pixel coordinates 206
 - pixel value 207
- pixel statistics 212
- pixel value 22
- Planck's constant 2
- planetary nebulae 521
- plate coordinates 254
- Pogson scale 272
- Pogson, Norman 271
- point operations 337
- point-spread function 29
- Poisson distribution 38
- Poisson noise 488
- polar alignment 113
- power-law unsharp mask 394
- precession 250
- Prewitt operators 386
- progressive-scan CCDs 16
- proper motion 250
- Q**
- quantize transfer function 353
- R**
- rate errors 94
- RAW file format 57
- raw image 43
- raw instrumental magnitude 275, 276
- readout noise 43
- resampling 334
- residual image 481
- resolution 81
- retina
 - cone cells 9
 - rod cells 9
- retina, human 9
- RGB filter matrix 538
- RGB triad 22, 572
- Richardson, William H. 507
- Richardson-Lucy iteration 507
- root mean square 41
- rotation 325
- RR Lyrae stars 296
- RS Canis Venaticorum stars 296
- S**
- sample 35
- saturated 21
- saturation 541
- sawtooth transfer function 353
- scaling 328, 357
- shot noise 43
- Sigma, as radius of star image 273
- signal bias 41
- signal-to-noise ratio 37
- significance image 490
- significant signal 486
- Skiff, Brian 292
- sky atlas software 93
- Sky Catalog 2000.0* 251
- sky flats 186
- sky-limited image 48
- slit spectrograph 309
- slit spectrograph images 316

Index

- Smithsonian Astrophysical Observatory Catalog (SAO)* 251
- SNR 37
- Sobel operators 386
- solar-system targets
 - Jovian Satellites 152
 - Jupiter 152
 - Lunar Imaging 154
 - Mars 152
 - Mercury 151
 - Moon 154
 - Neptune 154
 - Saturn 154
 - Sun 155
 - Uranus 154
 - Venus 151
- spatial filters 377
- spatial frequency 453
- spatially encoded 572
- spectral resolution 312
- spectral sensitivity 83
- spectroscopy 225
- spectrum
 - analysis 319
 - calibration 319
 - image properties 311
- standard coordinates 253
- standard deviation 35, 209, 214
- stellar
 - parallax 268
- stretch scaling 356
- support frames 165
- surface brightness for celestial objects 81
- synchrotron emission 518
- T**
- Tagged Image File Format (see TIFF)
- technique 113
- thermal frame 158, 173
- three-sigma detection 486
- TIFF 57, 59
- topographic operator 419
- Track 659
- track-and-stack imaging 447
- tracking sensitivity 94
- transfer curve 244
- transfer functions 343
- translation 321
- triangular unsharp mask 391
- trichromatic 514
- tri-color imaging 523
- Tukey, J. W. 469
- tutorials
 - astrometry 614, 631
 - basic skills 614, 615
 - calibration 614, 621
 - deep sky images 614
 - fast Fourier transform 614, 655
 - image enhancement 614, 644
 - brightness scaling 645
 - convolution filtering 649
 - deconvolution 651
 - deep-sky images 665
 - histogram shaping 647
 - morphological processing 654
 - multiple image processing 659
 - planetary images 670
 - unsharp masking 650
 - image evaluation 614, 626
 - image registration and blinking 614, 664
 - multiple image processing 614
 - photometry 614, 635
 - multiple-image photometry 639
 - single-image photometry 637
 - single-star photometry 636
 - planetary images 614
 - spectroscopy 614, 642
- twilight flats 185
- Tycho catalog 252
- U**
- UBV system, primary standards 281
- UBV(RI) filters for CCD photometry 282
- undersampling 29
- unsharp mask 388
- USNO-A2.0* catalog 252
- USNO-SA2.0* catalog 252
- V**
- Van Cittert deconvolution 506
- Van Cittert, P.H. 506
- variance 214
- Vierte Fundamental Katalog 251
- vignetting 102, 103, 106, 162
- W**
- wavelet coefficient 480
- wavelet conditional operator 485
- wavelet function 479
- wavelet noise filter 485
- wavelet scale 477
- wavelet spatial filter 496
- wavelet spatial filtering 484

wavelet transform 480
webcam 31
white balance 576
window reflections 104
Wollaston, William 303

Wratten filters 549

Z

Z 275
Z (zero point) 275