

SUBJECT INDEX

- absolute magnitude 54, 144, 155, 259
- absorption lines 13, 105, 151
- abundance of elements 19, 166
- accretion disk 108–11, 124, 133, 153, 155
- active galactic nuclei (AGN) 150, 153, 155
- adaptive optics 211
- airglow 181, 209
- Am-Fm class 37, 116
- ångstrom 257
- Ap-Bp class 116
- apparent magnitude 11
- astronomical unit (AU) 11
- asymptotic giant branch (AGB) 10, 67, 174
- Atacama Large Millimeter Array (ALMA) 11, 78, 108, 142
- Baade, Walter 143
- Balmer decrement 62, 69, 109–10, 133, 137, 156, 175–6
- Be shell stars 105, 109
- Be stars 100
- big bang 15
- binary star *see spectroscopic binaries*
- bipolar nebula 108, 174
- BL Lacertae object 151, 156
- black hole 26, 91, 123–4, 143, 153–6, 165
- blazar *see BL Lacertae object*
- blend 8
- Boeshaar–Keenan classification 72
- Bonner Spektralatlas 8, 262
- break-up limit 100
- bremsstrahlung 175, 182–3
- bright giants 18
- Bright Stars Catalog 10
- brown dwarf 19, 61
- Bunsen, Robert 14
- C/O ratio 72–3, 78
- calcium H+K lines 36, 62, 87
- calcium triplet 166
- calibration
 - high precision 205
 - intensity 8
 - light source 213
 - wavelength 8, 156
- Cannon, Annie 15, 116
- carbon 67, 72, 78, 80–1, 89, 143, 173
- carbon monoxide 15, 47
- carbon star 85, 174, 179, 215
- cataclysmic variable 124, 133
- central star (PN) 12, 85, 91, 174, 177, 184, 253
- Chandra telescope 11, 142
- Chandrasekhar mass limit 85, 143–4
- chemical separation 116
- chromosphere 13, 54
- circumstellar disk 100–1
- circumstellar dust 68, 78, 86
- colliding wind binary 92
- comet 198
- composite spectrum 12, 17, 19, 91, 111, 124–5, 150–1, 168
- constellation 10, 247
- continuum 16, 257–8
- contraction 111, 155
- coronal mass ejections (CME) 142
- Curtis, Heber 150
- DADOS 7, 265
- dark frame 7
- dark matter 10, 150
- diatomic molecule 47, 62, 78
- diffuse galactic light (DGL) 209
- dispersion, spectra 7, 265
- dissociation energy 72
- distance 9–10
- distribution, spectral types 20
- Doppler effect 145, 149, 152–3, 156, 181–2
- double peak emissions 54, 101, 128, 152–3
- Draper, Henry 15, 78, 127
- dredge up process 68, 72, 80
- dust cloud 108, 110, 142, 153, 166, 173
- dust particles 176
- early/late spectral type 15
- Earth's atmosphere 176, 198, 204
- eclipsing binary 123
- effective temperature 10, 12, 86, 173, 251
- electron
 - density N_e 184
 - gas 144
 - ground state 173, 255
 - temperature T_e 173
 - transition 93, 257
- emission line 19, 109, 128, 134, 198, 257
- emission nebula 173–84
- emission/shell cores 19, 54, 101, 109, 133, 137, 168
- energy saving lamp (ESL) 213
- epoch time 126
- ESO 11, 175
- excitation class 152, 184, 253
- expansion velocity 25, 181–2
- extragalactic objects 9–10, 149, 177
- extrasolar planets 125
- fast rotators 30
- Fe II (42) multiplet 109–10, 155
- Filippenko, Alexej 143, 146–7
- flare stars 2, 62, 65
- flat field 7
- fluorescence 211
- fluorescent lamps 214
- flux
 - calibration 146, 176
 - density 257
- forbidden lines 10, 134, 178
- Fraunhofer lines 13
- Fraunhofer, Joseph von 13
- frequency 173, 257
- FUor (FU Ori type) 109, 111
- fusion zone 67, 89
- FWHM *see spectral lines*
- FWZI *see spectral lines*
- G band CH molecular 16, 36, 42, 47, 62, 150
- galactic nebulae 10
- galaxies
 - evolution 149
 - integrated spectral type 150
 - morphological classification 149
 - parameters 10
 - spectroscopic classification 150
 - supermassive black hole 153
 - type absorption line 150
 - type LINER 150
 - type Seyfert 153
 - type starburst 152
- GALEX 11, 174
- gamma-ray burst 91, 132, 144
- gas discharge lamp 11, 173, 209, 213
- gas disk 101
- gauss, unit 257
- Gaussian fit 118, 125, 156
- glow starter 213–14
- Gould Belt 23
- grating 7
- gravitational field 86
- gravitational redshift 86
- Gurzadyan, Grigor 154, 176–7, 253
- H II region 26, 152, 173
- Harvard Classification System 15, 78
- Harvard Observatory 15
- H-Balmer series 16, 18, 24, 36, 43, 63, 89, 133, 137, 155
- He II Pickering series 93, 183
- heliocentric 125, 150
- helium flash 67, 117
- helium-rich stars 117, 119
- helium-weak stars 117
- Henry Draper Catalog 10–11
- Herbig Ae/Be stars 108–10
- Herschel, William 86
- Hertzsprung–Russell diagram (HRD) 15
- Hg-Mn class 116
- hollow cathode lamp 214
- horizontal branch (HB) 11, 67, 80
- hot subdwarfs 117
- Hubble
 - constant 11, 149
 - Edwin 110, 149
 - law 156
 - parameter 11
 - space telescope 11, 96, 132
- HWHD *see spectral lines*
- HWHM *see spectral lines*
- HWZI *see spectral lines*
- hydrocarbon flame 215

- hypergiants 18
 hypernova 144
- ILLSS catalog 8
 inclination angle 100
 infrared radiation 100
 instrumental response 176
 integrated spectra *see composite spectrum*
 integrated starlight (ISL) 209
 interstellar absorption 16, 19, 92, 105, 128, 146, 152, 166, 176
 interstellar matter (ISM) 11, 93, 108, 142, 166, 174, 182
 interstellar reddening 146
 ionization
 collisional 184
 degree 24, 30
 energy 16, 26, 174, 176, 179, 255
 front 179
 nebula 23, 175
 photo 93, 209
 stage 89–90, 93, 96
- IRIS 7, 11, 178, 266
- jet 108, 128, 156–7
 joule, unit for energy 11, 257
 Julian date (JD) 11, 126
- Keenan 1993 system 79–80
 Keenan, Philip 18
 Kellmann, Sanford 18
 Kepler's laws 123
 Kirchhoff, Gustav 14
- λ Bootis class 115
 Lagrangian point 123
 Landé factor 118
 lanthanum monoxide 15
 laser 211
 LBV stars 24, 96
 Lemaître, Georges 149
 light curve 123, 128, 133, 144
 light pollution xi, 7, 181, 183, 209, 212–13, 216
 lightning discharges 215
 line identification 8
 lithium 68, 72, 81, 111
 log g value *see surface gravity*
 long period variable (LPV) 11, 69
 low mass object 80
 luminosity class 18, 24, 26
 luminosity effect 26, 32, 38, 56, 63
 luminous supergiants 18
 Lyman limit 173
- magnesium triplet 37, 42, 46, 48, 55, 150, 152
 magnetar 118
 magnetic
 activity 54, 62
 field modulus, mean 117–18
 fields 48, 87, 108
 flux density 11
 white dwarf 86
- main sequence stars 18, 20
 mass loss 80, 89, 100, 132, 179, 182, 204
 mass transfer 72, 74, 80, 133, 137
 Maury, Antonia 116, 118, 127
 maximum light 134, 137, 143–4, 147
 McCook and Sion, classification 86
 Merrill–Sanford bands (MS) 80
 mesospheric sodium layer 209, 211
 metal line stars 116
 metallicity *see abundance of elements*
 metals 10
- meteor 211
 methane 197
 microquasar 124
 Milky Way 23, 93, 123, 165
 Mira variables 67, 134, 174
 MK C system 78
 MK classification system 18, 116
 Morgan, William 18
- neon glow lamp 213
 neutron star 23, 118, 123–4, 143, 174
 night sky spectrum 209
 noble gases 214
 normal giants 18
 normalization, spectral intensity 8
 novae
 absolute magnitudes 132
 binary system 124
 classical 133
 dwarf 133
 recurrent 133
 Tololo classification 135
 nuclear runaway reaction 132, 142
- OB association 23
 orbital period 127
- P Cygni profile 25, 96, 111
 Payne-Gaposchkin, Cecilia 15, 168
 peak intensity *see spectral lines*
 peculiar CP stars 115–19
 photon
 energy 173
 wavelength 257
 photosphere 10, 12, 116
 Pickering, Edward 15, 36, 93, 215
 Planck energy equation 173
 planetary nebulae 67, 91, 173
 emission lines 178
 examples 179–81
 excitation classes 184
 list 253
 recording 177
 plasma 173, 175
 plasma diagnostics 176–7
 PMS protostars 179–81
 polarization 86, 157
 population I/II 117, 165
 post-AGB phase 67
 post-AGB stars 174, 179
 prefixes, suffixes 19
 proper motion 26, 63
 protoplanetary accretion disk 85, 108
 protoplanetary nebulae 85, 174
 pseudo-continuum 8, 150, 176
 pseudo-photosphere 109, 132–3, 168, 179
 pulsar 174, 182–3
 pulsation variables 42
 pulsations 69, 100
- quasar 150, 153–6
- radial velocity 12, 86, 93, 125, 145–6, 156, 181–2
 radiation intensity 10
 radiation pressure 117
 radiation source 96, 173
 radio source 154
 recombination 26, 173, 209
 red dwarf 61–3
 red giant 78, 132–3, 136–7, 168
 red giant branch (RGB) 67
 red giant stage 89
 reflection nebulae 110, 173
- relativistic velocity 124, 155–6
 rest wavelength 8, 92, 125, 257
 return period 133, 137
 roAP stars 116
 Roche lobe 123, 132
 rotation velocity $v \sin i$ 10, 30, 67, 117, 149
 rotational variable 116–17
 runaway star 26
- s*-process 72, 74, 78–9
 Scalo and Ross index 72
 Schmidt, Maarten 154
 Secchi classes 14
 Secchi, Angelo 14–15, 55, 78, 100, 197, 262
 seeing xi, 177, 211
 Shapley, Harlow 150
 shell burning process 67
 shockwaves 69, 93, 142, 152, 154, 184
 silicon carbide, SiC₂ 81
 Slipher, Vesto 149, 181, 197, 211, 215
 Smith CP classification 115
 Smith WR classification 90
 sodium D1, D2 lines 16, 62, 78, 92, 111, 150, 198, 211
 sodium flash 211
 sodium high pressure lamp 209
 sodium nightglow 211
 sodium vapor lamp 213
 southern sky 46, 61, 91
 spacetime lattice 156
 special classes, suffixes/prefixes 19
 spectra (atlas)
 calibration 7
 line identification 8
 processing 7
 recording 7
 selection 7
 spectral class C *see carbon star*
 spectral class D *see white dwarfs*
 spectral classes
 A 16, 110, 204
 B 16, 96, 100
 F 16, 169
 G 17, 46–8
 K 17, 53–6
 L, T, Y 19
 M 17, 67
 M(e) (AGB) 68–70, 72
 MS (AGB) 68, 72
 O 16, 23–6, 143
 S (AGB) 68, 72–4
 SC (AGB) 68, 78
 spectral flux calibration 8, 143
 spectral flux density 257
 spectral lines
 blends 8
 Doppler broadening 153, 156
 energy flux F 257
 equivalent width (EW) 258
 FWHM 92, 134, 145, 257
 FWZI 257
 HWHD/HWHM 258
 HWZI 258
 instrumental broadening 92
 peak intensity P 258
 pressure broadening 18, 32
 rotational broadening 32, 38, 119
- spectroscopic binaries
 apastron 124
 barycenter 125
 contact 123–4
 detached 123
 epoch time 127

- mass transfer 124
- orbital phase 126
- periastron 127
- SB1/SB2 system 125
- semi-detached 123
- SpectroWeb 8, 205
- spectrum variables 115
- standard candle 144
- standard star 143, 176, 204
- star clusters
 - age estimation 166–9
 - analysis 166
 - blue straggler 168
 - CaT method 166
 - globular clusters 165
 - open clusters 165
 - turn-off point 166
- star inventory 152, 168
- Stark effect 36, 86, 181
- stellar atmospheres 18
- Strömgren radius 179
- subdwarf (VI) 117
- subgiant (IV) 18
- sunspots 54
- supergiants 25, 31, 38, 43, 62, 81, 96, 111, 124
- supernovae 146
 - carbon fusion scenario 144
 - core collapse scenario 143
 - remnant (SNR) 142, 174, 181
 - type Ia 85, 124, 143
 - type Ib 143
 - type Ic 143
 - type II 85, 143, 181
- surface gravity 85–6, 124
- Swan bands 81, 198, 215
- Swan, William 78
- symbiotic stars 72, 74, 133, 137
- synchrotron radiation 151, 156, 175, 182–3
- technetium 68, 74
- telluric absorption 12, 16, 157, 204
- temperature sequence 15, 72, 79
- terminal velocity 12, 92, 97, 132, 134
- terrestrial light sources 209
- theory of relativity
 - general (GTR) 11, 86
 - special (STR) 12
- titanium monoxide (TiO) 15–16, 55–6, 62, 69, 137, 204
- T-Tauri star 108–11, 155
- UV radiation 173, 209
- Van Maanen, Adriaan 87
- Vatican Observatory 14
- viscosity 100
- white dwarfs 18, 30, 67, 72, 91, 123–4, 168, 173
- Wilson–Bappu effect 54
- wind accretion 133, 137
- WR nebulae 91, 182
- WR stars 96, 183
- WRPN spectra 12, 91, 174
- xenon high power lamp 214
- X-ray binaries 124
- X-ray source 93, 155–6, 175, 183
- yttrium monoxide (YO) 15, 72
- ZAMS 12
- Zeeman split 118
- zirconium monoxide (ZrO) 15, 19, 68, 72, 78
- zodiacal light (ZL) 12, 209
- z*-value 10, 12, 149, 156, 259
- Zwicky, Fritz 143, 261

STELLAR INDEX

- 11 Cam 101
- 120 Tau 101
- 15 Mon 23
- 16 Tau, Celaeno 167
- 17 Tau, Electra 167
- 18 Sco 46
- 18 Tau 167
- 19 Tau, Taygeta 167
- 20 Tau, Maia 167
- 21 Tau, Asterope 167
- 23 Tau, Merope 167
- 25 Tau, Alcyone 167
- 27 Tau, Atlas 167
- 28 Tau, Pleione 100, 105
- 29 CMa 23
- 30 CMa 23
- 48 Per 101
- 53 Cam 118
- 66 Oph 101
- 68 Cyg 26
- AG Car 96
- AM CVn 125, 133
- BD Cam 73–4, 134
- EG And 133, 137
- FU Ori 109, 111
- Gliese191, Kapteyn's Star 117
- Gliese273, Luyten's Star 62
- Gliese388, AD Leo 62–3
- Gliese411, Lalande 21185 62–3
- Gliese699, Barnard's Star 62–3
- Gliese873, EV Lacertae 62
- HD 5005 23
- HD 37776 117, 119
- HD 41335 101
- HD 44179 85, 179
- HD 45995 101
- HD 47103 118
- HD 70331 118
- HD 75049 118
- HD 119419 118
- HD 126515, Preston's Star 118
- HD 137509 118
- HD 145708 118
- HD 175362 118
- HD 215441, Babcock's Star 118
- HD 318107 118
- HDE226868 124
- P Cyg 96–7, 134
- Proxima Centauri 20, 61
- R Cyg 73–4
- R Gem 73–4
- R Lep, Crimson Star 81
- R Lyn 73
- R Mon 109
- R Scl 78
- RR Lyrae 42
- S Dor 96, 134
- S UMa 73
- SS Cyg 133, 137
- Sun 18, 20, 46–7, 54, 197, 204–5
- T Tau 110
- U Cas 73
- UV Cet 62
- V Cnc 73
- VV Cep 124
- VY CMa 61
- W Ori 81
- WD 0046 +051, Van Maanen 87
- WD 0413 –077, 40 Eridani B 87
- WD 0644 +375, Gliese246 87
- WR7 92, 183
- WR11 91
- WR22 175
- WR102 93
- WR124 91–2
- WR133 183
- WR136 182–3
- WR140 92
- WR142 89, 93
- WZ Cas 81, 215
- Z Psc 81
- α And, Alpheratz 117
- α Aql, Altair 37
- α Aur, Capella 46
- α Boo, Arcturus 54
- α Cam 23
- α Car, Canopus 37, 42
- α Cen, Sadalmelik 46
- α CMa A, Sirius A 37, 87, 116–17
- α CMa B, Sirius B 37, 85–6
- α CMi A, Procyon A 9, 42
- α CMi B, Procyon B 85
- α Cyg, Deneb 38
- α Gem, Castor 37
- α Her, Ras Algethi 18
- α Hya, Alphard 53
- α Leo, Regulus 31
- α Lyr, Vega 38, 117
- α Ori, Betelgeuse 61
- α Per, Mirfak 43
- α Sco, Antares 61–2
- α Tau, Aldebaran 55–6
- α UMi, Polaris 16
- α Vir, Spica 32, 124, 127
- α² CVn, Cor Caroli 115–17
- β Aqr, Sadalsuud 46
- β Cas, Caph 43
- β Cyg B, Albireo B 30, 32
- β Gem, Pollux 54, 56
- β Her, Kornephoros 46
- β Lyr, Sheliak 124
- β Ori, Rigel 31
- β Peg, Scheat 61
- β Per, Algol 123, 244
- β Sco, Acrab 125
- γ Cas 100–1
- γ Leo, Algieba 111
- γ Per 46
- γ Vir, Porrima 43
- δ Boo 46
- δ Cas, Ruchbah 18, 38
- δ Cep 42
- δ Ori, Mintaka 24
- δ Sco, Dschubba 101
- ε Ori, Alnilam 31
- ε Vir, Vindemiatrix 46–7, 150
- ζ Leo, Adhafera 42
- ζ Oph 23
- ζ Ori, Alnitak 24, 124
- ζ Pup, Naos 23, 243
- ζ Tau 105
- ζ UMa A, Mizar A 124, 126–7
- η Boo, Muphrid 46–7
- η Car 96, 134, 144
- θ Cygni 74
- θ¹ Ori C 26, 178
- ι Ori, Nair al Saif 23, 243
- λ Ori, Meissa 23, 243
- μ Gem, Tejat Posterior 18
- ξ Per, Menkhib 23
- ο Cet, Mira 69–70, 73
- σ Ori A 23, 243
- φ Sgr 31
- X Oph 101
- Ψ Per 101

OBJECT INDEX: DEEP SKY AND SOLAR SYSTEM

1ES 1959+650, blazar 259	M45, OCL 100, 167	NGC 7009, PN 180
2ZW136, Glx (AGN) 259	M57, PN 177, 180	NGC 7662, PN 253
3C273, QSO 154–6, 259	M67, OCL 165	Nova Cygni 1600 96, 134
3C371, QSO 259	M77, Glx (AGN) 153	Nova Delphini V339 135
7ZW118, Glx (AGN) 259	M82, Glx 145, 150, 152	Nova Sgr 1991 136
B3 0754+394, Glx (AGN) 259	M94, Glx 151, 153	Nova T CrB 137
BL Lac, blazar 259	M1-92, PN 174	Nova T Pyxidis 132
C/1996 B2, comet Hyakutake 215	Mars, planet 197	
C/2009 P1, comet Garradd 198	MCG 11-19-006, Glx (AGN) 259	PG 0026+129, Glx (AGN) 259
Cyg X-1, X-ray source 124	Moon, lunar eclipse 198	PG 0804+762, QSO 259
Cygnus Loop, SNR 142, 174	MR 2251-178, Glx (AGN) 259	PG 0844+349, Glx (AGN) 259
H+X Persei, OCL 165	Mrk180, blazar 259	PG 1211+143, Glx (AGN) 259
HE 1029-1401, QSO 259	Mrk205, Glx (AGN) 259	PG 1351+640, Glx (AGN) 259
HS 0624+6907, QSO 259	Mrk304, QSO 259	PG 1634+706, QSO 259
Hyades, OCL 165	Mrk421, blazar 157, 259	PG 1718+481, QSO 259
IC418, PN 179	Mrk478, Glx (AGN) 259	PKS 0405-123, QSO 259
IRAS 01072-0348, Glx (AGN) 259	Mrk501, blazar 259	PKS 0521-36, blazar 259
IRAS 17596+4221, Glx (AGN) 259	Mrk509, Glx (AGN) 259	PKS 0735+17, blazar 259
IRAS 21219-1757, Glx (AGN) 259	Mrk734, Glx (AGN) 259	PKS 2155-304, blazar 259
Jupiter, planet 197	Mrk926, Glx (AGN) 259	PKS J0757+0956, blazar 259
KUV 18217+6419, QSO 259	Mrk1298, Glx (AGN) 259	PKS J0854+2006, blazar 259
Large Magellanic Cloud (LMC) 146	Mrk1383, Glx (AGN) 259	PKS J1517-2422, blazar 259
M1, SNR 142, 154, 181–2	Mrk1502, Glx (AGN) 259	S5 0014+81, QSO 259
M2, GCL 165	Neptune, planet 198	Saturn, planet 197
M3, GCL 165, 168	NGC 281, GN 23, 173	Sco X-1, X-ray source 124
M5, GCL 165, 168	NGC 604, GN 173	SN1984L 146
M13, GCL 165, 168	NGC 991, Glx 147	SN1987A 146
M15, GCL 165	NGC 1555, GN 111	SN1987M 146
M31, Glx 149–50	NGC 2070, GN 173	SN2014J 142–3, 145, 152
M42, GN 23, 173, 175, 178	NGC 2261, GN 109	SS 433, X-ray source 124
	NGC 2359, GN 92, 175, 183	Titan, moon 198
	NGC 2715, Glx 147	Ton 1388, QSO 259
	NGC 3372, GN 173	Uranus, planet 198
	NGC 6210, PN 179	Venus, planet 197
	NGC 6514, GN 173	
	NGC 6543, PN 174	
	NGC 6888, GN 92, 175, 182	