



Contents

1 Tools of the Trade.....	1
1.1 Angular Measurement.....	1
1.2 Distances in Astronomy	4
1.3 Brightness and Luminosity of Astronomical Objects	11
1.4 Magnitudes.....	13
1.5 The Visually Brightest Stars	18
1.6 The Colors of Stars	22
1.7 The Sizes of Stars.....	27
1.8 The Constituents of Stars	30
2 The Solar System.....	33
2.1 Early History of Astronomy.....	33
2.1.1 The Geocentric Universe	33
2.1.2 The Scientific Method	35
2.1.3 Ancient Greek Science	37
2.1.4 The Ptolemaic System	38
2.1.5 The Copernican Revolution.....	41
2.1.6 Tycho—The Great Observer	42
2.1.7 Kepler—The Great Theoretician.....	43
2.1.8 Galileo—The Great Experimenter	47
2.1.9 Newton—The Genius	49
2.2 Observing the Solar System.....	53
2.2.1 The Moon	54
2.2.2 Mercury	54
2.2.3 Venus	54

2.2.4	Jupiter	55
2.2.5	Uranus	55
3	Spectroscopy and the Spectral Sequence	57
3.1	Spectra and Spectroscopy	57
3.2	Stellar Classification	62
3.3	Amateur Astronomical Spectroscopy	66
3.4	Redshift and Blueshift.....	75
4	The Hertzsprung-Russell Diagram	77
4.1	Introduction.....	77
4.2	The H-R Diagram and Stellar Radius	79
4.3	The H-R Diagram and Stellar Luminosity	81
4.4	The H-R Diagram and Stellar Mass.....	83
5	The Interstellar Medium and Protostars	85
5.1	Introduction	85
5.2	Nebulae.....	87
5.3	Emission Nebulae.....	87
5.4	Dark Nebulae.....	96
5.5	Reflection Nebulae	100
5.6	Molecular Clouds	102
5.7	Protostars	103
5.8	The Jeans Criterion.....	105
6	Star Birth	109
6.1	The Birth Of A Star	109
6.2	Pre-Main-Sequence Evolution and the Effect of Mass	112
6.3	Mass Loss and Mass Gain	117
6.4	Star Formation Triggers	119
7	Galactic Clusters and Stellar Associations	123
7.1	Galactic Star Clusters	124
7.2	Stellar Associations and Streams	134
8	The Sun, Our Nearest Star.....	139
8.1	From the Core to the Surface	139
8.2	The Proton-Proton Chain	142
8.3	Energy Transport from the Core to the Surface	145
9	Binary Stars and Stellar Mass	147
9.1	Binary Stars	147
9.2	The Masses of Orbiting Stars	152
10	Life on the Main Sequence	155
10.1	Lifetimes of Main Sequence Stars.....	155
10.2	Red Giant Stars.....	159
10.3	Helium Burning and the Helium Flash	162
10.4	Globular Star Clusters and the H-R Diagram.....	165

10.5	Post-Main Sequence Star Clusters—The Globular Clusters	166
10.6	Pulsating Stars	173
10.7	Why Do Stars Pulsate?	173
10.8	Cepheid Variables and the Period-Luminosity Relation	176
10.9	Temperature and Mass of Cepheids	178
10.10	RR Lyrae and Long-Period Variable Stars	179
11	Star Death: White Dwarfs & Planetary Nebulae	183
11.1	The Death Of Stars	183
11.2	The Asymptotic Giant Branch.....	183
11.3	Dredge-Ups	185
11.4	Mass Loss and Stellar Winds	186
11.5	Infrared Stars	186
11.6	The End of an AGB Star's Life	187
11.7	Planetary Nebulae.....	190
11.8	White Dwarf Stars	196
12	Star Death: Supernovae, Neutron Stars & Black Holes	203
12.1	High-Mass Stars and Nuclear Burning.....	203
12.2	Supernovae and the Formation of Elements.....	206
12.3	Supernova Remnants	209
12.4	Supernovae Types.....	212
12.5	Pulsars and Neutron Stars.....	215
12.6	Black Holes	218
13	Exoplanets.....	225
13.1	Introduction	225
13.2	Types of Exoplanets	226
13.3	Techniques of Detection.....	229
13.4	Observing Exoplanet Systems.....	234
14	Galaxies.....	239
14.1	Introduction	239
14.2	Galaxy Types.....	240
14.3	Galaxy Structure.....	240
14.4	Stellar Populations.....	241
14.5	Hubble Classification of Galaxies	242
14.6	Gérard de Vaucouleurs's Classification of Galaxies.....	245
14.7	The Milky Way	246
14.8	Observing Galaxies	247
14.9	Clusters of Galaxies.....	256
15	Active Galaxies	259
15.1	Active Galactic Nuclei (AGN's).....	259
15.2	Origin of Nuclear Activity	260
15.3	Classification of Active Galaxies	260
15.4	AGN Variability.....	262

15.5	Starburst Galaxies	264
15.6	Observing Active Galaxies	266
16	Cosmology.....	271
16.1	The Big Bang	272
16.2	Hubble and Humason.....	274
16.3	After the Big Bang	276
16.4	Evidence for and Against the Big Bang Theory	280
16.5	The Inflationary Model	281
16.6	Dark Matter and Dark Energy.....	283
16.7	The Future of the Universe	286
16.8	Cosmology and the Amateur Astronomer	287
16.9	Final Thoughts	291
Appendix 1: Degeneracy.....		293
Appendix 2: Book, Magazines, Organizations, and Equipment.....		295
Index.....		299



<http://www.springer.com/978-3-319-11643-3>

Astrophysics Is Easy!

An Introduction for the Amateur Astronomer

Inglis, M.

2015, XIX, 302 p. 283 illus., 43 illus. in color., Softcover

ISBN: 978-3-319-11643-3