

David Leverington

A HISTORY OF ASTRONOMY

from 1890 to the Present



Springer

London Berlin Heidelberg New York

Paris Tokyo Hong Kong

Barcelona Budapest

Contents

<i>Preface</i>	ix
<i>Introduction</i>	xi
1 • The Sun	1
Early Work	1
The Temperature of the Sun and its Generation of Energy	6
The Corona	9
Sunspots and the Disturbed Sun	11
The Quiet Sun and the Interplanetary Plasma	15
The Solar Constant	18
The Solar Spectrum	22
2 • The Moon	23
Early Work	23
The Surface	26
The Origin and Subsequent History of the Moon	29
3 • The Origin of the Solar System	31
Early Theories	31
Collisions and Close Encounters	33
Condensing Nebulae Re-examined	35
4 • The Terrestrial Planets	37
Mercury	37
Venus	42
The Earth	46
Mars	53
5 • The Gas Giants	62
Jupiter	62
Saturn	71

Uranus	80
Neptune	87
 6 • Small Bodies of the Solar System	 96
Pluto	96
The Asteroids	103
Comets	109
Meteorites	118
 7 • Stellar Evolution and Stellar Structures	 120
Early Work	120
The Luminosity of Stars	125
The Harvard Classification	126
Initial Evolutionary Ideas	128
Ionisation and the Abundance of Hydrogen in Stellar Atmospheres	133
The Surface Temperature of Stars	135
The Internal Structure of Stars	136
The Source of Energy in Stars	141
The MKK and BCD Classification Systems	145
Later Evolutionary Ideas	148
Stellar Populations	152
 8 • Variable and Double Stars	 154
Early Work	154
Short Period Variables	159
Long Period Variables	162
Irregular Variables	163
Flare Stars	164
Eclipsing Binaries	165
Non-Eclipsing Binaries	169
 9 • Young Stars, Old Stars and Stellar Explosions	 171
Young Stars	171
Pulsars	173
Novae and Supernovae	178
Black Holes	204
 10 • The Milky Way	 208
Early Work	208
Dimensions and Structure	211
The Interstellar Medium	221
Nebulae in the Milky Way	226

11 • Galaxies	230
The Nature and Distance of Spiral Nebulae	230
Red Shifts	236
Quasars	237
Dwarf Galaxies	246
Galactic Evolution	247
12 • Cosmology	252
Early Cosmological Theories	252
Revisions to the Hubble Constant	253
The Microwave Background Radiation	256
The Missing Mass	257
13 • Optical Telescopes and Observatories	259
Early Telescopes	259
Early Observatories	261
The Transition to Reflectors	263
The Harvard College Observatory	264
Mount Wilson	267
Palomar Mountain and the 200 inch	270
Schmidt Telescopes	272
South Africa	273
Kitt Peak	274
The Multi-Mirror Telescope	275
Mauna Kea	276
La Palma	278
The Anglo-Australian Observatory	279
The European Southern Observatory	280
14 • Tools and Techniques	283
Photography	283
Spectroscopy	290
Photometry	296
Other Tools and Techniques	304
15 • Radio Astronomy	310
Early Radio Astronomy	310
Radio Telescopes	314
16 • Space Research	320
Introduction	320
Results from Early Sounding Rockets	320
Sputniks and the Formation of NASA	322
The Race to the Moon	324
Early Solar Plasma Research	326

Missions to the Terrestrial Planets 327

Pioneers 10 and 11 331

Voyagers 1 and 2 333

The Halley Intercepts 339

Orbital Observatories 341

17 • Modern Astronomy in Context 355

Introduction 355

1890–1914 355

1914–1939 356

1939–1970 357

1970 to the Present 358

References and Further Reading 361

Units 364

General Abbreviations Used 366

The Greek Alphabet 367

Subject Index 369

Name Index 379