



---

# Contents

<i>Preface</i>	xi
<b>1 The history of solar observation: from sun worship to the space age</b>	1
1.1 Early ideas about the sun	1
1.2 Sunspot observations	6
1.3 The aurora	14
1.4 Solar spectroscopy	16
1.5 Solar eclipses and the solar atmosphere	20
1.6 Application of photography	26
1.7 Spectroheliography and solar magnetic fields	31
1.8 The sun and relativity	33
1.9 Solar–terrestrial connections	34
1.10 Measurements of solar energy	38
1.11 The nature of the sun	41
1.12 Radio astronomy and the space age	43
<b>2 The solar interior</b>	47
2.1 Structure of the interior and its energy source	47
2.2 The neutrino problem	53
2.3 Solar oscillations	58
2.4 The origin of the sun's magnetic field	67
<b>3 The solar photosphere</b>	73
3.1 The solar granulation and other fine structure	73
3.2 The solar differential rotation and large-scale flows	78
3.3 The solar diameter	79
3.4 Radiation from the photosphere: the temperature minimum	81
3.5 The Fraunhofer lines	87
3.6 Broadening and splitting of spectral lines	94
3.7 The photosphere's chemical composition	99
3.8 The photospheric magnetic field	103

<b>4 The solar chromosphere</b>	107
4.1 The chromosphere in profile	107
4.2 The chromospheric Fraunhofer lines	110
4.3 The chromosphere in spectroheliograms	113
4.4 The chromosphere in non-visible wavelengths: the transition region	118
4.5 The nature and heating of the chromosphere	127
<b>5 The solar corona</b>	131
5.1 The white-light corona	131
5.2 The hot corona	137
5.3 Coronal radiation in non-visible wavelengths	143
5.4 The form of the corona: coronal holes	148
5.5 Coronal magnetic fields	155
5.6 Quiescent prominences	158
5.7 Heating of the corona	165
<b>6 The active sun</b>	168
6.1 Sunspots	168
6.2 Active regions	181
6.3 Solar flares	187
6.4 Coronal mass ejections	211
6.5 Theories of solar activity	215
<b>7 The sun and the solar system</b>	226
7.1 The sun's gravitation and the solar system	226
7.2 The solar wind	229
7.3 Interaction of the solar wind with the planets and comets	239
7.4 Geomagnetic disturbances and the aurora	247
7.5 The sun and the earth's atmosphere: the ionosphere	255
7.6 The earth's weather and climate	265
7.7 Human activities and the earth's atmosphere	269
<b>8 The sun and other stars</b>	274
8.1 The sun as a star	274
8.2 Properties of stars	276
8.3 Evolution of the sun and other stars	288
8.4 Stellar chromospheres, coronae and winds	300
8.5 Stellar activity	307
8.6 Asteroseismology	313
<b>9 Solar energy</b>	314
9.1 Amount of solar energy	314
9.2 Solar insolation	318
9.3 Harnessing solar energy: photosynthesis	319
9.4 Harnessing solar energy: thermal systems	321
9.5 Harnessing solar energy: the solar cell	325
9.6 Harnessing indirect forms of solar energy	328
<b>10 Observing the sun</b>	331
10.1 Optical instruments and observatories	331

10.2	Solar radio telescopes	340
10.3	Solar spacecraft observatories	343
10.4	Observing the sun for amateurs	352
	<b>Epilogue: future directions</b>	360
	<b>Appendices</b>	362
1	Physical and astronomical constants	362
2	Finding the heliographic co-ordinates of a sunspot	363
	<b>Glossary of selected terms</b>	366
	<i>Bibliography</i>	373
	<i>References</i>	378
	<i>Index</i>	381