

An Anthology of Visual Double Stars

Modern telescopes of even modest aperture can show thousands of double stars. Many are faint and unremarkable but hundreds are worth searching out. Veteran double star observer Bob Argyle and his co-authors take a close-up look at their selection of 175 of the night sky's most interesting double and multiple stars. The history of each system is laid out from the original discovery to what we know at the present time about the stars. Wide-field finder charts are presented for each system along with plots of the apparent orbits and predicted future positions for the orbital systems. Recent measurements of each system are included, which will help you to decide whether they can be seen in your telescope as well as giving advice on the aperture needed. Double star observers of all levels of experience will treasure the level of detail given in this guide to these jewels of the night sky.

Bob Argyle has observed double stars since 1966. He has been Director of the Webb Deep-Sky Society's Double Star Section since 1970. He edited *Observing and Measuring Visual Double Stars* (Springer 2012) and writes monthly columns on double stars for *Astronomy Now* and the Webb Society. He is a Fellow of the Royal Astronomical Society, a Member of the International Astronomical Union, and Editor of *Observatory* magazine.

Mike Swan worked for the Ordnance Survey in England. He has extensive experience in computer graphics and uranography and was solely responsible for the *Webb Society Star Atlas*. He is currently completing a two-part *Atlas of Galactic Clusters*. For the present volume he has produced the finder charts, the all-sky charts, and the orbital plots.

Andrew James has been interested in double stars since the late 1970s. He is a long-term member, and past President, of the Astronomical Society of New South Wales (ASNSW), and formed its Double Star Section in 1979. His interests include the historical backgrounds and works of various discoverers of southern double stars.

An Anthology of Visual Double Stars

Bob Argyle

University of Cambridge

Mike Swan

Webb Deep-Sky Society

Andrew James

Astronomical Society of New South Wales

CAMBRIDGE UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

79 Anson Road, #06–04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org

Information on this title: www.cambridge.org/9781316629253

DOI: 10.1017/9781316823163

© Robert W. Argyle, Mike Swan, and Andrew James 2019

This publication is in copyright. Subject to statutory exception and to the provisions of relevant collective licensing agreements, no reproduction of any part may take place without the written permission of Cambridge University Press.

First published 2019

Printed in the United Kingdom by TJ International Ltd. Padstow Cornwall

A catalogue record for this publication is available from the British Library.

Library of Congress Cataloging-in-Publication Data

Names: Argyle, Robert W., author. | Swan, Mike, 1952– author. | James, Andrew (Astronomer), author.

Title: An anthology of visual double stars / Robert W. Argyle (University of Cambridge),

Mike Swan (Webb Deep-Sky Society), Andrew James (Astronomical Society of New South Wales).

Description: Cambridge ; New York, NY : Cambridge University Press, 2019. |

Chiefly a catalog of double stars. | Includes bibliographical references and index.

Identifiers: LCCN 2018061697 | ISBN 9781316629253 (pbk. : alk. paper)

Subjects: LCSH: Double stars–Catalogs. | Double stars–Observers' manuals. |

Astronomy–Observers' manuals. | Amateur astronomy.

Classification: LCC QB821 .A74 2019 | DDC 523.8/41–dc23

LC record available at <https://lcn.loc.gov/2018061697>

ISBN 978-1-316-62925-3 Paperback

Cambridge University Press has no responsibility for the persistence or accuracy of URLs for external or third-party internet websites referred to in this publication and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

Dedicated to Angela Argyle, Angela Kelly, and the memory of
Catherine McMahon (1964–2001)

CONTENTS

About the Authors			
Acknowledgements			
1			
Introduction	xii	3. κ^1 Scl = BU 391 = WDS J00094–2759AB	80
2		4. GRB 34 And = WDS J00184+4401AB	82
Observing Double Stars		5. β Tuc = LCL 119 = WDS J00315–6257AC	84
3		6. BU 395 Cet = WDS J00373–2446	86
History of Measurement Techniques		7. η Cas = STF 60 = WDS J00491+5749AB	88
4	1	8. 36 And = STF 73 = WDS J0550+2338AB	90
Observational Double Star Groups		9. β Phe = SLR 1 = WDS J01061–4643AB	92
5		10. ζ Phe = RMK 2 = WDS J01084–5515AB,C	94
Double Star Resources		11. ζ Psc = STF 100 = WDS J01137+0735AB	96
6	3	12. κ Tuc = HJ 3423/I 27 = WDS J01158–6853AB/CD	98
Biographies of Visual Double Star Observers		13. τ Scl = HJ 3447 = WDS J01361–2954AB	102
7	7	14. p Eri = Δ 5 = WDS J01398–5612	104
Myths, Mysteries, and One-Offs		15. $\gamma^{1,2}$ Ari = STF 180 = WDS J01535+1918AB	106
8		16. α Psc = STF 202 = WDS J02020+0246	108
Catalogue Lists and Charts		17. 10 Ari = STF 208 = WDS J02037+2556AB	110
I The Catalogue in Right Ascension Order		18. $\gamma^{1,2}$ And = STF 205 = WDS J02039+4220A,BC	112
II The Catalogue in Constellation Order		19. o Cet = Joy 1 = WDS J02193–0259AaAb	114
III All-Sky Finder Charts		20. ι Cas = STF 262 = WDS J02291+6724AB	116
9	12	21. α UMi = Polaris = STF 93 = WDS J02318+8926AB	120
The Catalogue		22. γ Cet = STF 299 = WDS J02433+0314AB	122
1. STT 547 And = WDS 00057+4549AB		23. $\theta^{1,2}$ Eri = PZ 2 = WDS J02583–4018	124
2. STF 3062 Cas = WDS J00063+5826		24. ϵ Ari = STF 333 = WDS J02592+2120AB	126
	18	25. α For = HJ 3555 = WDS J03121–2859	128
		26. JC 8 Eri = WDS J03124–4425AB	130
	46	27. 95 Cet = AC 2 = WDS J03184–0056	132
		28. STF 425 Per = WDS J03401+3407AB	134
		29. 32 Eri = STF 470 = WDS J03543–0257	136
	52	30. σ^2 Eri = STF 518 = WDS J04153–0739BC	138
		31. 80 Tau = STF 554 = WDS J04301+1538	140
	52	32. 2 Cam = STF 566 = WDS J04400+5328AB,C	142
	58	33. 14 Ori = STT 98 = WDS J05079+0830	144
	66	34. β Ori = Rigel = STF 668 = WDS J05145–0812AB	146
		35. STF 634 Cam = WDS J05226+7914AB	148
		36. η Ori = DA 5 = WDS J05245–0224AB	150
		37. θ Pic = Δ 20 = WDS J05248–5219AB,C	152
	72	38. δ Ori = STFA 14 = WDS J05320–0018AC	154
	76	39. ζ Ori = STF 774 = WDS J05408–0156AB	156
	78	40. θ Aur = STT 545 = WDS 05597+3713AB	158

41. η Gem = BU 1008 = WDS J06149+2230	160	88. 24 Com = STF 1657 = WDS J12351+1823	258
42. 4 Lyn = STF 881 = WDS J06221+5922AB	162	89. γ Cen = HJ 4539 = WDS J12415-4858AB	260
43. ϵ Mon = STF 900 = WDS J06238+0436AB	164	90. γ Vir = STF 1670 = WDS J12416-0127AB	262
44. β Mon = STF 919 = WDS J06288-0702A,BC	166	91. β Mus = R 207 = WDS J12463-6806AB	266
45. Δ 30 Pup = WDS J06298-5014	168	92. 35 Com = STF 1687 = WDS J12533+2115AB	268
46. 15 Mon = STF 950 = WDS J06410+0954AB	170	93. $\mu^{1,2}$ Cru = Δ 126 = WDS J12546-5711AB,C	270
47. Sirius = α CMa = AGC 1 = WDS J06451-1643	172	94. $\alpha^{1,2}$ CVn = STF 1692 = WDS J12560+3819AB	272
48. 12 Lyn = STF 948 = WDS J06462+5927AB,C	174	95. θ Mus = RMK 16 = WDS J13081-6518	274
49. 38 Gem = STF 982 = WDS J06546+1311AB	176	96. α Com = STF 1728 = WDS J13100+1732AB	276
50. Δ 39 Car = WDS J07033-5911	178	97. J Cen = Δ 133 = WDS J13226-6059AB,C	278
51. $\gamma^{1,2}$ Vol = Δ 42 = WDS J07087-7030	180	98. ζ UMa = STF 1744 = WDS J13239+5456AB,C	280
52. 145 CMa = HJ 3945 = WDS J07166-2319AB	182	99. 25 CVn = STF 1768 = WDS J13375+3618AB	282
53. δ Gem = STF 1066 = WDS J07201+2159AB	184	100. STF 1785 Boo = WDS J13491+2659	284
54. Δ 47 CMa = WDS J07247-3149AB	186	101. 3 Cen = H 3 101 = WDS J13518-3300	286
55. α Gem = STF 1110 = WDS J07346+3153AB	188	102. $\kappa^{1,2}$ Boo = STF 1821 = WDS J14135+5147AB	288
56. STF 1126 CMi = WDS J07401+0514AB	190	103. α Cen = RHD 1 = WDS J14396-6050AB	290
57. $\gamma^{1,2}$ Vel = Δ 65 = WDS J08095-4720	192	104. ζ Boo = STF 1865 = WDS J14411+1344AB	294
58. ζ Cnc = STF 1196 = WDS J08122+1739AB,C	194	105. ϵ Boo = STF 1877 = WDS J14450+2704AB	296
59. $\kappa^{1,2}$ Vol = BSO 17 = WDS J08198-7131AB	198	106. ξ Boo = STF 1888 = WDS J14514+1906AB	298
60. δ Vel = I 10 = WDS J08447-5443AaAbB	200	107. 44,i Boo = STF 1909 = WDS J15038+4739	300
61. ι Cnc = STF 1268 = WDS J08467+2846AB	202	108. π Lup = HJ 4728 = WDS J15051-4703	302
62. ϵ Hydrae = STF 1273 = WDS J08468+0625AB,C	204	109. $\mu^{1,2}$ Lup = HJ 4753 = WDS J15185-4753AB	304
63. STF 1321 UMa = WDS J09144+5241AB	206	110. ϵ Lup = Δ 182 = WDS J15227-4441AB,C	306
64. 38 Lyn = STF 1334 = WDS J09188+3648AB	208	111. η CrB = STF 1937 = WDS J15232+3017AB	308
65. STF 1338 Lyn = WDS J09210+3811AB	210	112. γ Cir = HJ 4757 = WDS J15234-5919AB	310
66. ω Leo = STF 1356 = WDS J09285+0903AB	212	113. $\mu^{1,2}$ Boo = STFA 28 = WDS J15245+3723AB	312
67. ψ Vel = COP 1 = WDS J09307-4028	214	114. γ Lup = HJ 4786 = WDS J15351-4110AB	314
68. ν Car = RMK 11 = WDS J09471-6504	216	115. STT 298 Boo = WDS J15360+3948AB	316
69. γ Sex = AC 5 = WDS J09525-0806AB	218	116. $\zeta^{1,2}$ CrB = STF 1965 = WDS J15394+3638	318
70. I 173 Vel = WDS J10062-4722	220	117. Δ 194 TrA = WDS J15549-6045AB,C	320
71. $\gamma^{1,2}$ Leo = STF 1424 = WDS J10200+1950AB	222	118. ξ Sco = STF 1998 = WDS J16044-1122AB,C	322
72. J Vel = RMK 13 = WDS J10209-5603	224	119. ν Sco = H 5 6 = WDS J16120-1928 AB,CD	326
73. x Vel = Δ 95 = WDS J10393-5536AB	226	120. $\sigma^{1,2}$ CrB = STF 2032 = WDS J16147+3352AB	328
74. η Car = Δ 98 = WDS J10451-5941	228	121. α Sco = Antares = GNT 1 = WDS J16294-2626	330
75. μ Vel = R 155 = WDS J10468-4925	230	122. λ Oph = STF 2055 = WDS J16309+0159AB	332
76. u Car = Δ 102/3 Vel = WDS J10535-5851AB	232	123. ζ Her = STF 2084 = WDS J16413+3136	334
77. 54 Leo = STF 1487 = WDS J10556+2445	234	124. μ Dra = STF 2130 = WDS J17053+5428AB	336
78. ξ UMa = STF 1523 = WDS J11182+3132AB	236	125. η Oph = BU 1118 = WDS J17104-1544AB	338
79. STF 1527 Leo = WDS J11190+1416	240	126. α Her = STF 2140 = WDS J17146+1423AB	340
80. ι Leo = STF 1536 = WDS J11239+1032AB	242	127. δ Her = STF 3127 = WDS J17150+2450AB	342
81. STT 235 UMa = WDS J11323+6105AB	244	128. 36 Oph = SHJ 243 = WDS J17153-2636AB	344
82. STF 1555 Leo = WDS J11363+2747AB	246	129. MLO 4 Sco = WDS J17190-3459AB	346
83. 65 UMa = STF 1579 = WDS J11551+4629AB,D	248	130. 41G Ara = BSO 13 = WDS J17191-4638AB	348
84. D Cen = RMK 14 = WDS J12140-4543	250	131. $\rho^{1,2}$ Her = STF 2161 = WDS J17237+3709AB	350
85. STF 1639 Com = WDS J12244+2535AB	252	132. Δ 216 Ara = WDS J17269-4551AB,C	352
86. $\alpha^{1,2}$ Cru = Δ 252 = WDS J12266-6306AB	254	133. $\nu^{2,1}$ Dra = STFA 35 = WDS J17322+5511	354
87. γ Cru = Δ 124 = WDS J12312-5707AB	256	134. 95 Her = STF 2264 = WDS J18015+2136	356

135. τ Oph = STF 2262 = WDS J18031-0811AB	358	157. ϵ Equ = STF 2737 = WDS J20591+0418AB,C	408
136. 70 Oph = STF 2272 = WDS J18055+0230AB	360	158. 61 Cyg = STF 2758 = WDS J21069+3845AB	410
137. HJ 5014 CrA = WDS J18068-4325	364	159. H 1 48 Cep = WDS J21137+6424	412
138. 73 Oph = STF 2281 = WDS J18096+0400AB	366	160. τ Cyg = AGC 13 = WDS J21148+3803AB	414
139. α Lyr = Vega = H 5 39 = WDS J18369+3846AB	368	161. θ Ind = HJ 5258 = WDS J21199-5327	416
140. STF 2398 Dra = WDS J18428+5938AB	370	162. β Cep = STF 2806 = WDS J21287+7034AB	418
141. $\epsilon^{1,2}$ Lyr = STF 2382/3 = WDS J18443+3940AB,CD	372	163. μ Cyg = STF 2822 = WDS J21441+2845AB	420
142. β Lyr = STFA 39 = WDS J18501+3322AB	376	164. ξ Cep = STF 2863 = WDS J22038+6438AB	422
143. $\theta^{1,2}$ Ser = STF 2417 = WDS J18562+0412AB	378	165. 53 Aqr = SHJ 345 = WDS J22266-1645AB	424
144. ζ Sgr = HDO 150 = WDS J19026-2953AB	380	166. Krüger 60 Cep = WDS J22280+5742AB	426
145. γ CrA = HJ 5084 = WDS J19064-3704	382	167. ζ Aqr = STF 2909 = WDS J22288-0001AB	428
146. GLE 3 Pav = WDS J19172-6640	384	168. δ Cep = STFA 58 = WDS J22292+5825AB	430
147. β^1 Sgr = Δ 226 = WDS J19226-4428	386	169. 8 Lac = STF 2922 = WDS J22359+3938AB	432
148. $\beta^{1,2}$ Cyg = Albireo = STFA 43 = WDS J19307+2758AB	388	170. STF 2944 Aqr = WDS J22478-0414AB,C	434
149. 16 Cyg = STFA 46 = WDS J19418+5032AB	392	171. θ Gru = JC 20 = WDS J23069-4331AB	436
150. δ Cyg = STF 2579 = WDS J19450+4508AB	394	172. π Cep = STT 489 = WDS J23079+7523AB	438
151. θ Sge = STF 2637 = WDS 20099+2055AB,C	396	173. 72 Peg = BU 720 = WDS J23340+3120	440
152. α^1 Cyg = STFA 50 = WDS J20136+4644	398	174. 107 Aqr = H 2 24 = WDS J23460-1841	442
153. β Del = BU 151 = WDS J20375+1436AB	400	175. STF 3050 And = WDS J23595+3343AB	444
154. $\gamma^{1,2}$ Del = STF 2727 = WDS J20467+1607AB	402	Appendix	446
155. λ Cyg = STT 413 = WDS J20474+3629AB	404	References	451
156. RMK 26 Pav = WDS J20516-6226	406	Object Index	467

ABOUT THE AUTHORS

Bob Argyle

I have been observing double stars ever since I acquired a telescope in 1966. To this day I do not know what prompted me to give them special attention but I do know that using a copy of *Norton's Star Atlas* which was given to me by an early mentor, Frank Acfield of Newcastle-upon-Tyne, had an effect. I suspect it was the lack of up-to-date information about the separation and position angles included in the lists which accompanied each of the star maps that prompted me to start making observations, by eye at first. In my copy (the 15th edition of 1964), for example, the date of the given position angle and separation for the bright binaries was no later than 1938 and many of the wider pairs were 20 or 30 years older than that. This gave me the distinct impression that here was something useful that could be done, and I remember thinking that I must get a micrometer in order to do some of this work properly. At that time, however, micrometers were rare and expensive objects and I never did come across one to use on my 10-inch reflector.

Around this time I bought a copy of Webb's *Celestial Objects for Common Telescopes*, Volume 2, which was available then in the paperback reproduction issued by Dover. It is a little treasure chest of double stars and considerably expanded the number available to a small telescope compared to the lists in *Norton*. As a subscriber to *The Astronomer* magazine I followed the columns of 'From the Night Sky' written by John Larard, which described his observations of double stars made at Mill Hill using an 8-inch Cooke refractor.

John spent much, perhaps too much, of his energy bringing the Webb Society into being as he felt there was a distinct lack of direction in deep-sky and double star observation amongst the amateur community.

I joined the Webb Society in 1968 and was soon sending in observations of double stars to John, who was then Director of the Double Star Section. After a reorganisation in 1970 John became Director of the Nebulae and Clusters Section, and I was asked to direct the Double Star Section. I'm still doing it.



Figure 0.1 The 8-inch (20-cm) Thorowgood Cooke refractor at the Observatories, Cambridge. It was delivered to Dawes in 1865 and was left to the Royal Astronomical Society in 1927. It has been at the Institute of Astronomy, Cambridge, since 1929 (R. W. Argyle)

The 8-inch refractor at Cambridge Observatories is an historic instrument. Measurements started in 1990 and the programme continues to this day – 29 years on. This volume contains some results of these observations.

Mike Swan

I was employed as a cartographer with the Ordnance Survey (OS) for over 25 years, working in Southampton and Birmingham. Nearly 20 years of that time was spent working in all aspects of digital mapping. I retired from the OS early and moved to the dark skies of western Ireland.

Combining cartography with an enthusiasm for astronomy, it was only natural that I became a uranographer. I started creating maps of the stars from the mid 1970s, producing them professionally for various books and publications, most notably the 18th and 19th editions of Norton's *Star Atlas*. With the advent of home computing, and easy access to databases and software programs, it became easier and quicker to create maps of the stars. I have produced the *Webb Star Atlas* for the Webb Deep-Sky Society and I am currently working on Volume 2 of my two-part publication, *Atlas of Open Star Clusters*, the first part of which is now available.

For this present volume I produced the all-sky charts, the finder charts, and the orbital plots.

Andrew James

I have been interested in double stars since the late 1970s. I am a long-term member, and past President, of the Astronomical Society of New South Wales (ASNSW) and formed its Double Star Section in 1979. I presented many papers on double stars to the National Australian Convention of Amateur Astronomy (NACAA) between 1980 and 2014. In recent times I have focussed on southern double stars and the historical backgrounds and works of

various discoverers in Australia, including James Dunlop and Charles Rümker, who made the first southern double star catalogues.

Another associated interest is the astronomer Henry Chamberlain Russell, and various observational assistants, who found and measured many new doubles within the Sydney Observatory Double Star Programme between 1870 and 1900.

Further current investigations have recently extended to a new examination of Sir Thomas Brisbane's Paramatta Star Catalogue, created during the 1820s at Sydney, and its important connection to the discovery of double stars and deep-sky objects.

General southern historical accounts and information on double stars and some selected double stars also appear on my website, Southern Astronomical Delights www.southastrodel.com. I am still active in the local astronomical scene in Sydney, and between 2013 and 2015 I acted as a consultant to the design revamp of Sydney Observatory's new East Dome, used by the public – especially aimed for access by the disabled and seniors. My astronomical experience also extends to lecturing on the subject to Evening Colleges, and I have presented many talks over a large range of subjects. I am presently the Planetary Nebulae and Deep-Sky Section Leader of the ASNSW.

ACKNOWLEDGEMENTS

The data in this book relies heavily on several sources. The *WDS Catalog*, maintained by the United States Naval Observatory, is the clearing house for all observations of visual double stars. This database has been managed for a number of years by Dr Brian Mason and Dr Bill Hartkopf, whose prompt and generous cooperation with requests for data has been much appreciated.

When it was released the Hipparcos catalogue contained high-quality astrometric data for about 118,000 bright stars down to $V = 11$ or so. In particular the trigonometrical parallaxes were most welcome, especially in the case of binary stars where estimates of the total stellar mass in the system could be appreciably improved. In addition, photometry in two colours was also taken and that data has been used in this catalogue.

In April 2018, the Gaia project [682] released its second interim catalogue (*DR2*). This unprecedented compilation lists positions, proper motions, and parallaxes for about 1.6 billion stars, and, for a subset of these, radial velocities are also available. The astrometry of many bright, close, visual binaries will not be available until *DR3*, which is expected to be issued in 2020. The catalogue in this book uses *DR2* data wherever possible.

This work has made use of data from the European Space Agency (ESA) mission Gaia, www.cosmos.esa.int/web/gaia, processed by the Gaia Data Processing and Analysis Consortium (DPAC), www.cosmos.esa.int/web/gaia/dpac/consortium. Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement.

The authors are also indebted to the compilers of the SIMBAD catalogue, which has been invaluable, especially for checking references to papers on each system discussed.

RWA also would like to thank Christopher Taylor for permission to reproduce entries from his observing logbook, Michael Greaney for the conversion table in the Appendix, and Drs Henry Zirm and Jack Drummond for high-resolution images for inclusion in the text.

Throughout the course of this project, Mark Hurn, Librarian at the Institute of Astronomy, has been a reliable and sympathetic source of help, especially in locating the most obscure references.

Continuous help and encouragement from staff at CUP, notably Esther Miguéliz Obanos and Vince Higgs, is gratefully acknowledged.