The Southern Double Stars of James Dunlop III: Modern Version and Analysis of Accuracy of the First Dedicated Published Catalogue of Southern Double Stars

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Abstract: The first dedicated catalogue of southern double stars was published in 1829 by James Dunlop. Basing our work solely on the published data, we present a modern version of the catalogue with data from GAIA DR2 and, where unavailable, data from the ASCC in the *Appendix*. We also compare this modern data precessed back to B1825.0 with that of Dunlop's original catalogue and estimate the accuracy of his main parameters.

1. Introduction

This paper (Dunlop Paper III) continues a series of papers on the double stars of James Dunlop, one of three astronomers who worked at the privately owned observatory in Parramatta, NSW Australia in the 1820's. The Parramatta Observatory was the venture of Sir Thomas Makdougll Brisbane (1773-1860) the 6th British Governor of the Colony of NSW from 1822 to 1825.

In Dunlop Paper I (Letchford, White and Ernest, IN PRINT) we presented a history and description of the first published dedicated catalogue of southern double stars, by James Dunlop (1793-1848) and issued in 1829 as Approximate Places of Double Stars in the Southern Hemisphere, observed at Paramatta in New South Wales (Dunlop 1829). In Dunlop Paper II (Letchford, White and Ernest, IN PRINT) we presented modern designations of the pairs in Dunlop's original catalogue.

The Dunlop papers follow three papers (Rümker Papers I, II, and III) previously published in this journal on the double star work of another of the Parramatta astronomers, Carl Rümker (Letchford, White, and Ernest 2017; Letchford, White, and Ernest 2018a; Letchford, White, and Ernest 2018b).

In this paper (Dunlop Paper III), we present a modern version of the catalogue with data from The Gaia Catalogue Data Release 2 (GAIA DR2) and, where unavailable, data from the All-sky Compiled Catalogue of 2.5 million stars, 3rd version (ASCC). We also compare this modern data precessed back to B1825.0 (with proper motions taken into account) with that of Dunlop's original catalogue and estimate the accuracy of his main parameters.

2. Format of the Appendix "Modern Version of the Dunlop Catalogue"

We present in the Appendix a modern version of the Dunlop Catalogue based on online data using the Appendix from Dunlop Paper II (Letchford, White and Ernest, IN PRINT). All positions are ICRS, epoch J2000.0. The column details are given in Table 1.

3. Accuracy Analysis

All of the Dunlop doubles are considered slow moving (prior to further study) and so a comparison between Dunlop's published data and modern precessed values (with proper motion taken into account) should not differ significantly from those when Dunlop made his observations. Hence reasonable estimation of the accuracy of his various measures is possible.

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Table 1: Explanation of Columns in "Modern Version of the Dunlop Catalogue" (Appendix)

Column	**Name**	**Data**
1	DUN	A running catalogue entry corresponding to the entries of Dunlop, 1829. An asterisk (*) indicates that Dunlop observed this pair with the 3 1/4 refractor; without an asterisk, with the 9 inch reflector.
2	RA (h:m:s)	The Right Ascension (RA) of the primary star (the brighter of the pair or grouping) at ICRS, epoch J2000.0. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.
3	DE (d:m:s)	The Declination (DE) of the primary star (the brighter of the pair or grouping) at ICRS, epoch J2000.0. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.
4	WDS	Washington Double Star Catalog (WDS) designation. "one" indicates that only one star could be found. "two" indicates that two stars were found that are not recorded as double stars in the current WDS. So for "three", "four" and "five". "Unidentified" means that the pair remains unidentified.
5	Disc	The discoverer and component code following the WDS.
6	PA (deg)	The Position Angle of the secondary relative to the primary at ICRS, epoch J2000 in units of degrees, computed from positions obtained from the GAIA DR2 release (unless positions taken from ASCC).
7	Sep (as)	The separation of the secondary from the primary in units of arcseconds ("), computed from position obtained from the GAIA DR2 release (unless positions taken from ASCC).
8	Vmag1	The visual magnitude of the primary star taken from ASCC.
9	Vmag2	The visual magnitude of the secondary star taken from ASCC.
10	SpType1	The spectral type of the primary star, taken from ASCC.
11	SpType2	The spectral type of the secondary star, taken from ASCC.
12	pmRA1 (mas/yr)	The Right Ascension component of the proper motion of the primary star in units of milli-arcseconds per year. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.
13	pmDE1 (mas/yr)	The Declination component of the proper motion of the primary star in units of milli-arcseconds per year. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.
14	pmRA2 (mas/yr)	The Right Ascension component of the proper motion of the secondary star in units of milli-arcseconds per year. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.
15	pmDE2 (mas/yr)	The Declination component of the proper motion of the secondary star in units of milli-arcseconds per year. Taken from the GAIA DR2 release unless marked by an "A", in which case, data was not available from GAIA DR2 and was taken from ASCC.

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3.1 Equinox of Catalogue and Epochs of Observations

Like Rümker, Dunlop did not publish the equinox or the epoch of any measures in his catalogue. Following the method pioneered in Rümker Paper I (Letchford, White, & Ernest, 2017), we find the most likely equinox from the difference in the catalogues positions and the precessed positions of the primary star, as a function of equinox (see Figure 1). The best fit of these data corresponds to the likely date of the equinox of the Catalogue. For the sake of analysis we assume the epoch of each observation to be also this equinox date.

In this paper we refine the technique using a more detailed stellar reduction as detailed in The Astronomical Almanac for the Year 2018, pages B51-55,73-74 (Nautical Almanac Office 2017). Here we use high precision, including nutation and frame bias, and take into account parallax data available from GAIA DR2. The results are depicted in Figure 1. The effect of precession is given by the U-shaped curve and the effect of nutation by the wavy line.

It is clear from Figure 1 that the Equinox with the lowest total separation is J1825.1 (marked by the red circle). There is very little difference between J1825.1 and B1825.0, so we say with some confidence that Dunlop's Catalogue Equinox was B1825.0.

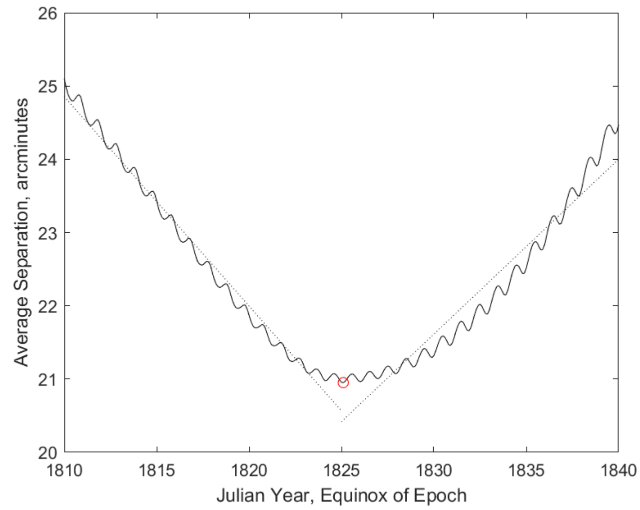

Figure 1. The average separation in arcminutes between the catalogued positions of the primary stars in Dunlop's catalogue and the precessed modern positions of these stars as a function of date. The wavy nature of the curve results from the inclusion of nutation in the formal calculation. Dotted lines are extrapolations of the precession effect.

3.2 Accuracy of Position of Primaries

Utilizing the new identifications and modern positions and proper motions, it is now possible to determine the accuracy of the position of the primary stars as reported by Dunlop using the same method as detailed in Rümker Paper I. Figure 2 is the target diagram for all DUN numbers for which sufficient data is currently available (see *Appendix* for modern star positions and proper motions).

All offsets in this paper are in this sense: 'Modern – Dunlop'. For example in Figure 2, the target diagram,

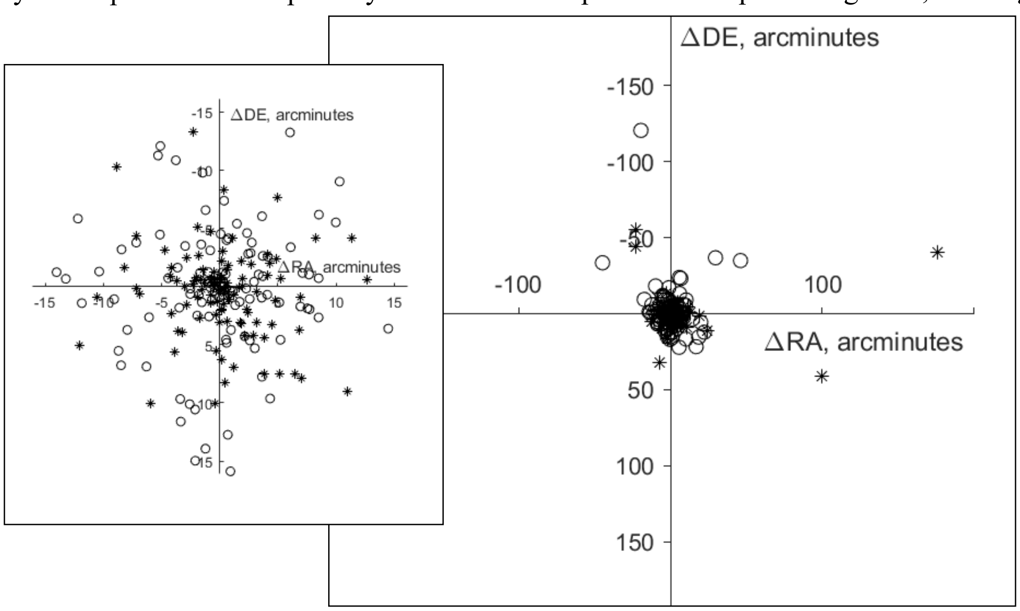

Figure 2. Target Diagram for all DUN numbers with sufficient data. Here '∗' represents the offset of primaries observed with the 3¼ inch refractor, 'o' those observed with the 9 inch reflector. Positions are compared at B1825.0 (Modern – Dunlop). The insert is the target diagram limited to 15 arcmin square.

'Modern' are modern positions (RA and DE) precessed to B1825.0, taking into account proper motions, and 'Dunlop' is the position as presented in his published Catalogue.

From Figure 2, the outliers can be immediately seen. We suggest that some of these are probably due to typographical errors or quadrant errors in the original catalogue. The vast majority of offsets fall within 15 arcminutes of the center in both ΔRA and ΔDE (as in inset of Figure 2). Confining our attention to this range, we present four histograms in Figures 3-6.

An analysis of the differences between the modern-but-precessed positions and those of Dunlop shows that there is no overall bias in the Dunlop positions. The mean differences in right ascension are 3 ± 2 arcmin for the 3 ¼ inch telescope and 12 ± 12 arcmin for 9 inch. The declination differences are 0.2 ± 1 arcmin and -4 ± 6 arcmin for the two instruments respectively. These estimates are from 115 pairs observed with the 3 ¼ inch and 122 pairs for the 9 inch, out of a possible 121 and 132 respectively.

Given the instruments at hand, we propose that Dunlop did a fine job and note that Herschel's criticisms (Letchford, White, Ernest, Paper I, in print) do not apply to Dunlop's positions of the primaries but rather to the accuracy of pair identification (for which see Letchford, White and Ernest, Dunlop Paper II, IN PRINT).

3.3 Accuracy of Position Angles

Precessing modern positions back to 1825.0 using modern proper motions and parallax, enabled us to compare Dunlop's published position angles with modern equivalents (see beginning of Section 3). Results of offsetting the position angles (modern PA (precessed to B1825.0) – average of Dunlop's PA) are given in Figures 7-8. It should be noted that Dunlop recorded data that enables position angles to be determined in up to four different ways (see Letchford, White and Ernest, Paper I, in print) and hence we take the average where available.

Of Dunlop's 121 pairs from the 3 ¼ inch, 98 had PA data that could be compared to modern precessed values. Of the 132 pairs from the 9 inch, 68 had sufficient data. The poorer quality work from the 9 inch is clearly indicated in the mean ΔPA° of ~ +2.5° as opposed to just ~ -0.9° for the 3¼ inch. Although there is much variation, Dunlop tended to over-measure his PAs from the 3 ¼ inch and over-estimate those from the 9 inch.

The doubles with the most extreme differences in PA were DUN 99* (extreme left of Figure 7) and DUN 78* (extreme right of Figure 7) for the 3 ¼ inch and DUN 115 (extreme left of Figure 8) and DUN 7 (extreme right of Figure 8) for the 9 inch. They and oth-

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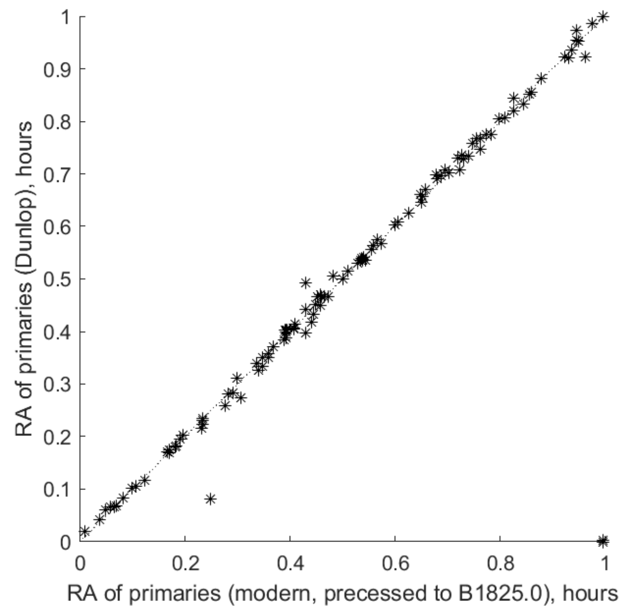

Figure 3. Cross plot of modern RA (precessed to B1825.0) and Dunlop's RA as published of primaries observed with the 31/4 inch refractor, at Equinox of Epoch B1825.0. RA whole hours have been truncated to better reflect the spread. Histogram inset is offset in Right Ascension limited to ± 15 arcmin fitted with a single peak Gaussian curve.

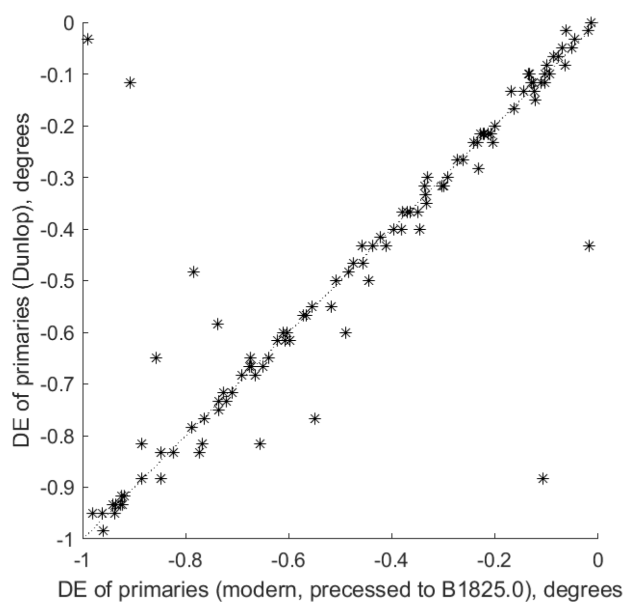

Figure 4. Cross plot of modern DE (precessed to B1825.0) and Dunlop's RA as published of primaries observed with the 31/4 inch refractor, at Equinox of Epoch B1825.0. DE whole degrees have been truncated to better reflect the spread. Histogram inset is offset in Declination limited to ± 15 arcmin fitted with a single peak Gaussian curve.

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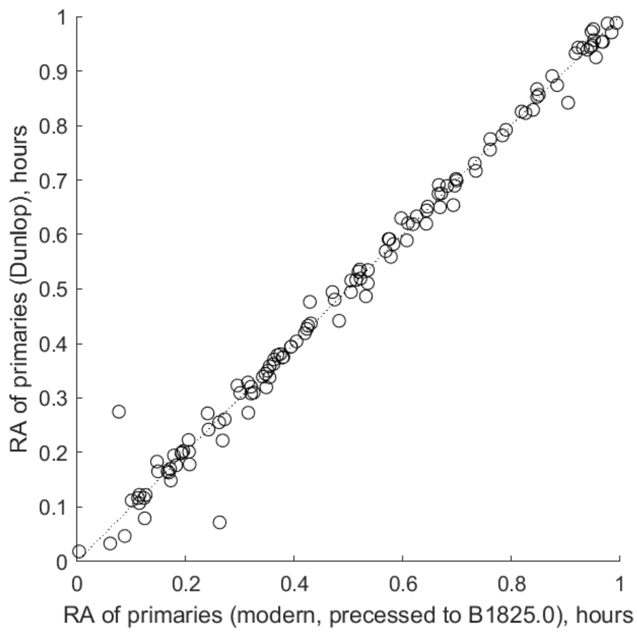

Figure 4. Cross plot of modern DE (precessed to B1825.0) and Dunlop's RA as published of primaries observed with the 31/4 inch refractor, at Equinox of Epoch B1825.0. DE whole degrees have been truncated to better reflect the spread. Histogram inset is offset in Declination limited to ± 15 arcmin fitted with a single peak Gaussian curve.

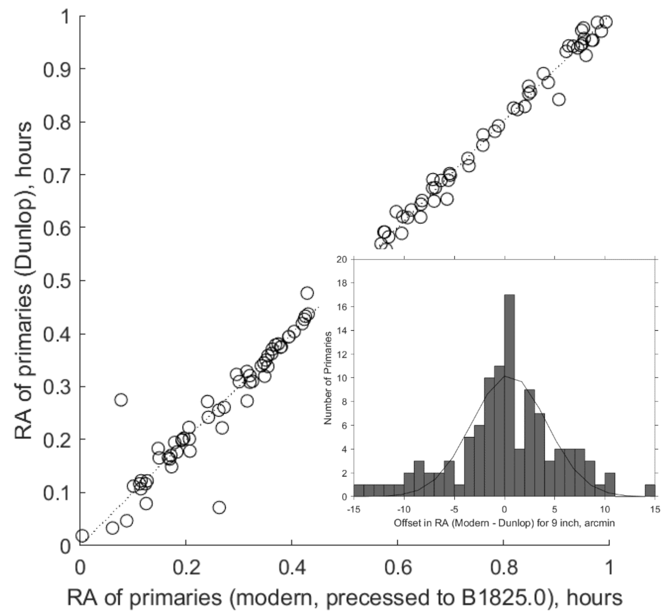

Figure 5. Cross plot of modern RA (precessed to B1825.0) and Dunlop's RA as published of primaries observed with the 9 inch reflector, at Equinox of Epoch B1825.0. RA whole hours have been truncated to better reflect the spread. Histogram inset is offset in Right Ascension limited to ± 15 arcmin fitted with a single peak Gaussian curve.

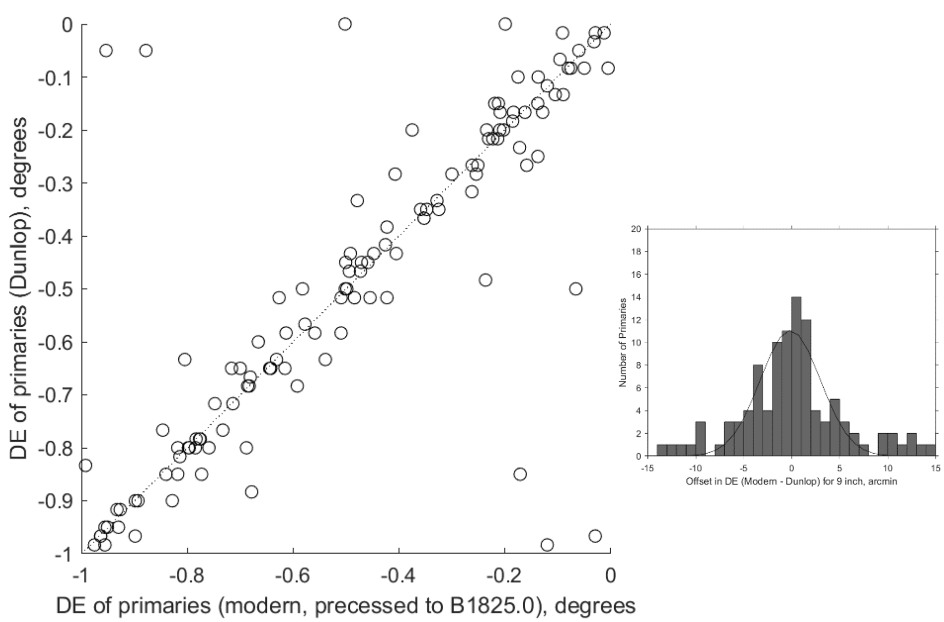

Figure 6. Cross plot of modern DE (precessed to B1825.0) and Dunlop's RA as published of primaries observed with the 9 inch reflector, at Equinox of Epoch B1825.0. DE whole degrees have been truncated to better reflect the spread. Histogram inset is offset in Declination limited to ± 15 arcmin fitted with a single peak Gaussian curve.

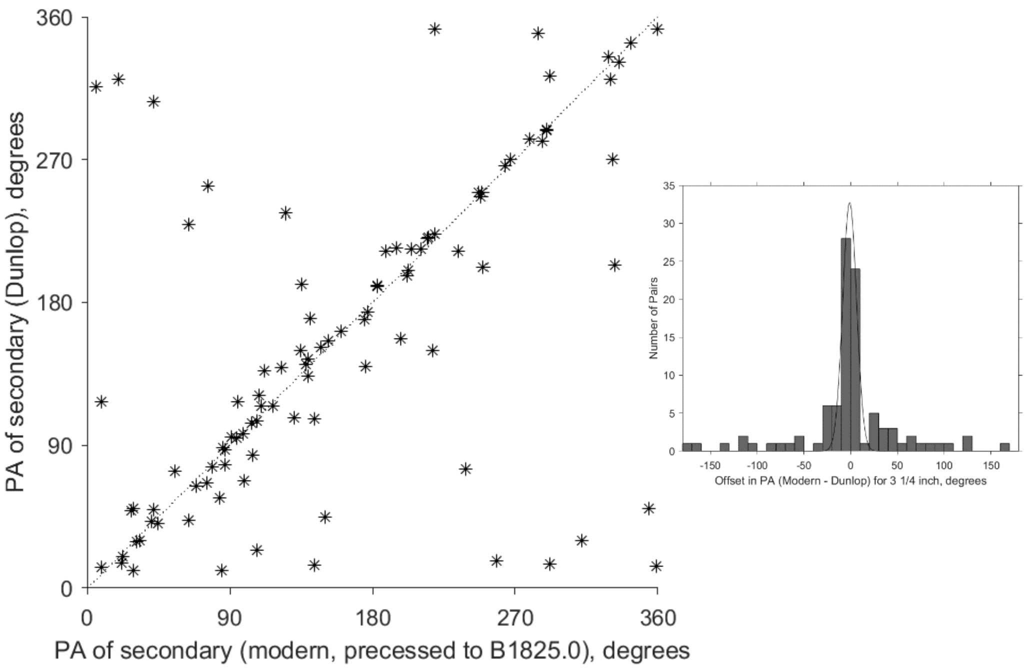

Figure 7. Cross plot of modern PA (precessed to B1825.0) and Dunlop's PA as published of pairs observed with the 3 ¼ inch refractor, at Equinox of Epoch B1825.0. Histogram inset is PA offset fitted with a single peak Gaussian curve.

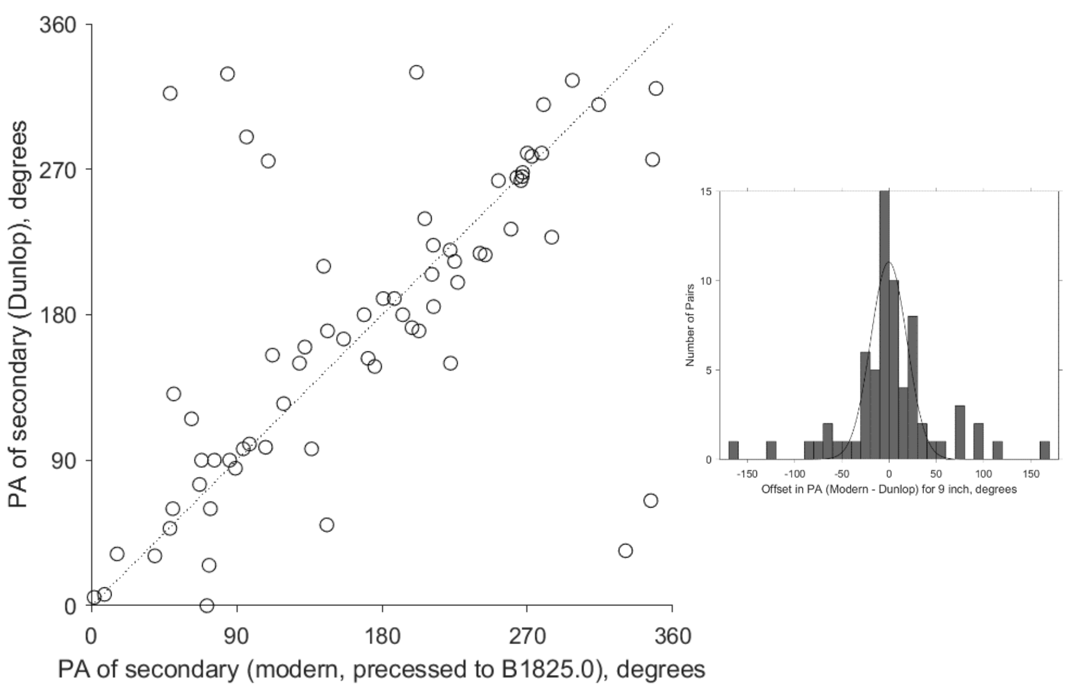

Figure 8. Cross plot of modern PA (precessed to B1825.0) and Dunlop's PA as published of pairs observed with the 9 inch reflector, at Equinox of Epoch B1825.0. Histogram inset is PA offset fitted with a single peak Gaussian curve.

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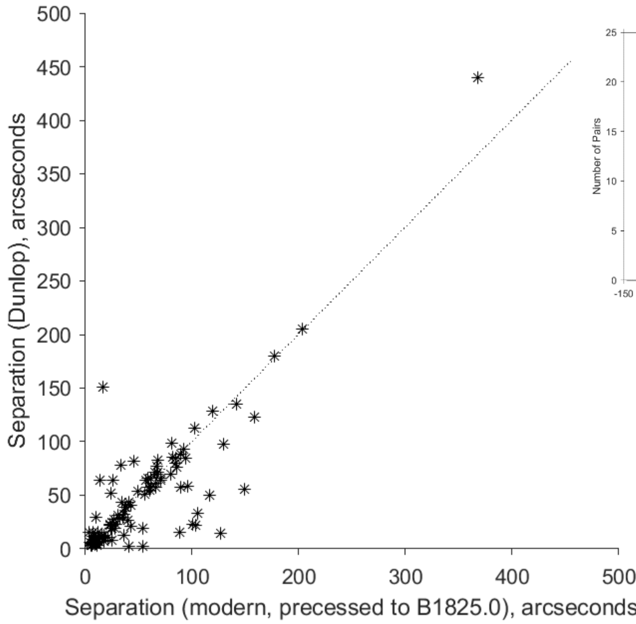


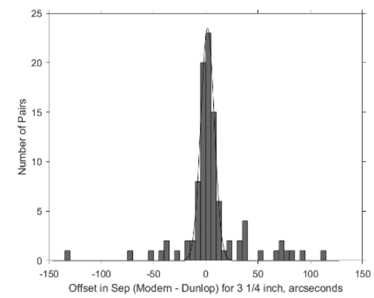
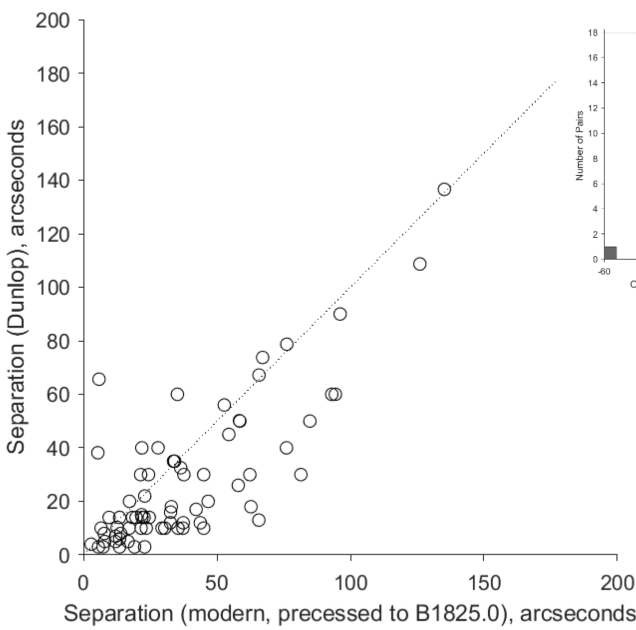


Figure 9. Cross plot of modern Separation (precessed to B1825.0) and Dunlop's Separation as published of pairs observed with the 3 ¼ inch refractor, at Equinox of Epoch B1825.0. Histogram inset is Separation offset fitted with a single peak Gaussian curve.



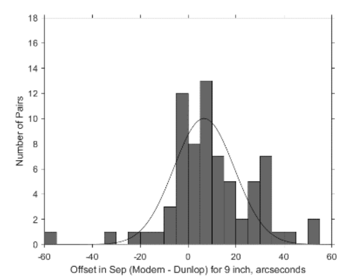


Figure 10. Cross plot of modern Separation (precessed to B1825.0) and Dunlop's Separation as published of pairs observed with the 9 inch reflector, at Equinox of Epoch B1825.0. Histogram inset is Separation offset fitted with a single peak Gaussian curve.

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ers are probably due to quadrant errors on the part of Dunlop. For example, in Dunlop's Catalogue, DUN 1* has the quadrant at "np" but should be "sf"; which explains in large part its PA offset of -133.4°.

3.4 Accuracy of Separations

Precessing modern positions back to 1825.0 using modern proper motions and parallax, enabled us to compare Dunlop's published separations (Sep) with modern equivalents. Results of offsetting the separations (modern Sep (precessed to B1825.0) – average of Dunlop's Sep) are given in Figures 9-10 and Table 4. It should be noted that Dunlop recorded data that enables separations to be determined in up to four different ways (see Letchford, White and Ernest, Dunlop Paper I, IN PRINT) and hence we take the average where available.

Of Dunlop's 121 pairs from the 3 ¼ inch, 100 had separation (Sep) data that could be compared to modern precessed values. Of the 132 pairs from the 9 inch, just 71 had sufficient data. The poorer quality work from

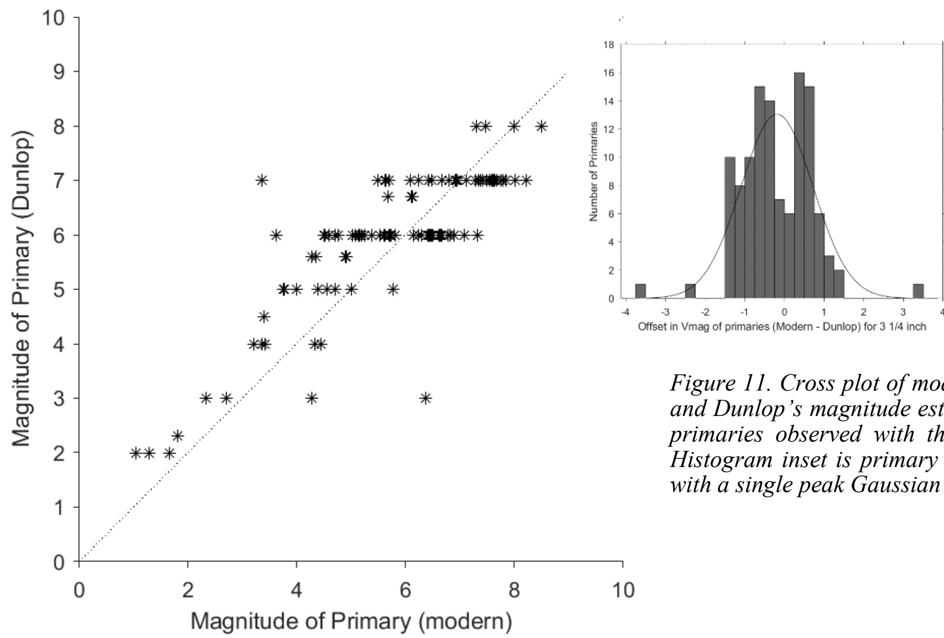

Figure 11. Cross plot of modern visual magnitudes and Dunlop's magnitude estimates as published, of primaries observed with the 3 ¼ inch refractor. Histogram inset is primary magnitude offset fitted with a single peak Gaussian curve.

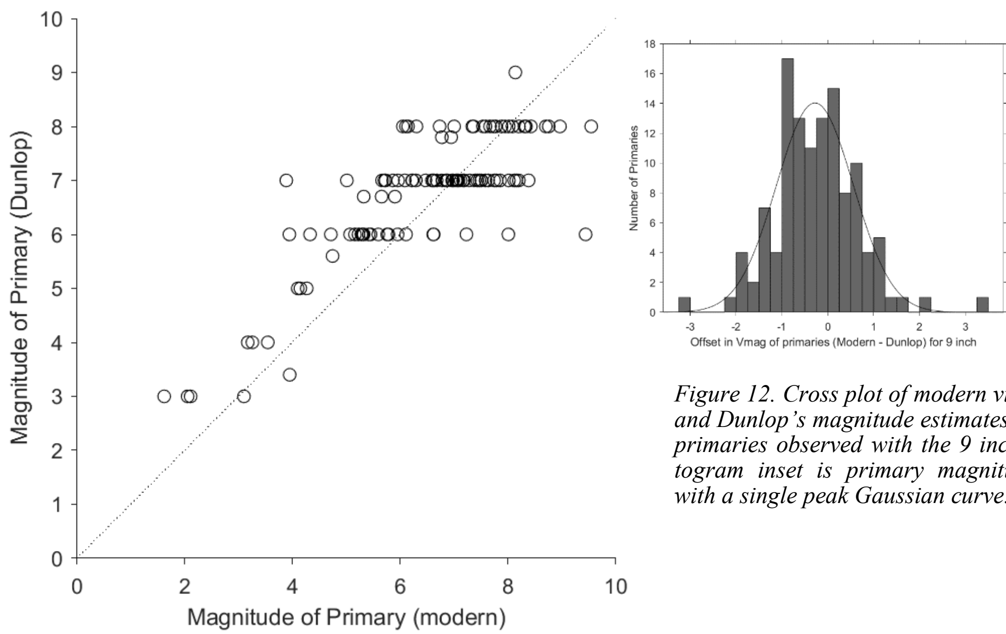

Figure 12. Cross plot of modern visual magnitudes and Dunlop's magnitude estimates as published, of primaries observed with the 9 inch reflector. Histogram inset is primary magnitude offset fitted with a single peak Gaussian curve.

the 9 inch is clearly indicated in the bias spread of ~12.7" as opposed to just ~6.5" for the 3¼ inch. Again, Dunlop did better at measuring separations with the 3 ¼ inch. Although with wide variation, Dunlop had a tendency to underestimate separations, especially with the 9 inch.

DUN 109* is unusual. The published Catalogue recorded one estimate of the separation as 2' 49.3" or 169.3" (the other estimate was calculated to be 132.8"). The correct quadrant is recorded, also the magnitude estimates are approximately correct, but the modern precessed separation is only ~16.7". There is no star with the right magnitude at ~169" from the primary. Dunlop's average PA for DUN 109* is ~106.6° the modern precessed value is ~143.3°.

3.5 Accuracy of Visual Magnitudes

Dunlop visually estimated the magnitudes of the stars at each telescope. Results of offsetting the visual magnitudes (modern Vmag (precessed to B1825.0) – average of Dunlop's magnitudes) of the primaries are given in Figures 11-12; those for the secondaries in Figures 13-14.

On average, Dunlop over-estimated the visual magnitude of the primaries by ~0.2 for both telescopes.

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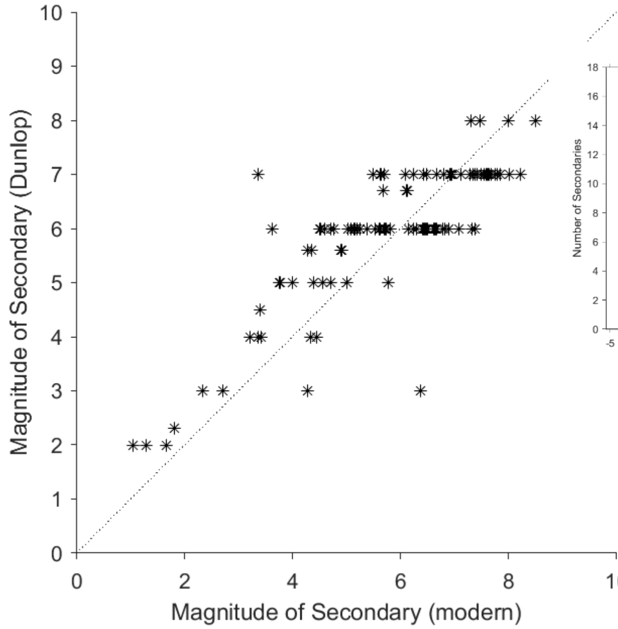


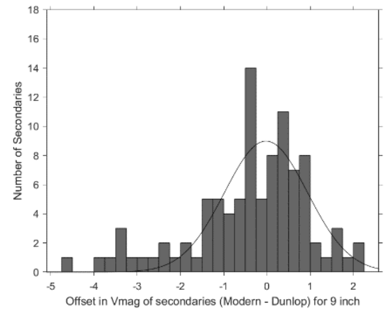
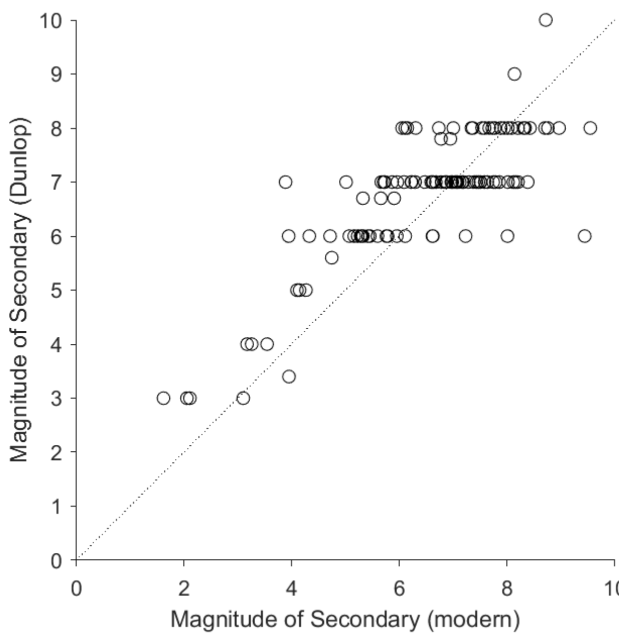


Figure 13. Cross plot of modern visual magnitudes and Dunlop's magnitude estimates as published, of secondaries observed with the 3 ¼ inch refractor. Histogram inset is secondary magnitude offset fitted with a single peak Gaussian curve.



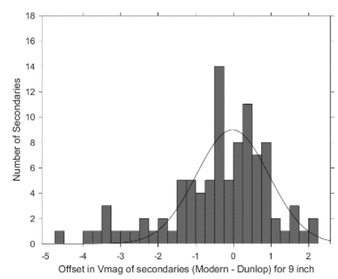


Figure 14: Cross plot of modern visual magnitudes and Dunlop's magnitude estimates as published, of secondaries observed with the 9 inch reflector. Histogram inset is secondary magnitude offset fitted with a single peak Gaussian curve.

Though the bias is relatively small, its uncertainties for both telescopes indicate that Dunlop was often up to 1 magnitude out, and frequently more. For further discussion on Dunlop's magnitude estimates, see Dunlop Paper I (Letchford, White and Ernest, Paper I, IN PRINT).

On average, Dunlop over-estimated the visual magnitude of the secondaries by ~0.3 for the 3 ¼ inch and ~0.4 for the 9 inch, more than for the primaries. The bias for both is also larger, meaning that, as for the primaries, Dunlop had a clear tendency for overestimation of the secondary magnitudes of up to 1 magnitude and often more.

4. Limiting Completeness Magnitudes

Using modern (ASCC) measures of magnitudes, and considering the primary and secondary magnitudes together, Figures 15 and 16 are histograms of the magnitudes measured with the 3 ¼ inch reflector and 9 inch refactor, respectively. They indicate a limiting completeness magnitude for Dunlop of ~7.5 through the 3

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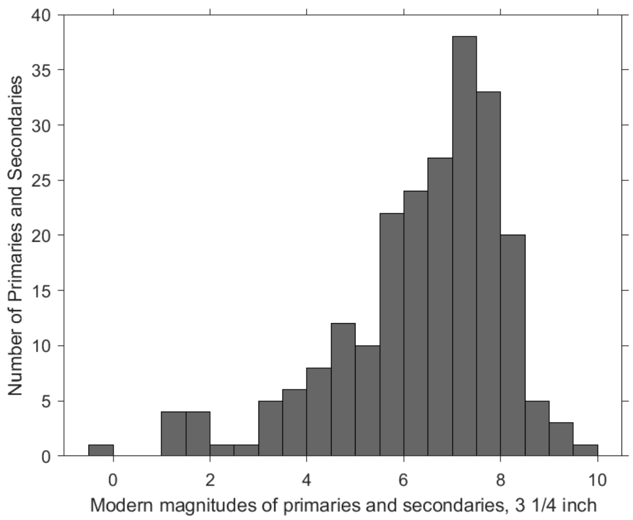

Figure 15: Histogram of modern magnitude measures of primary and secondary components observed with the 3 ¼ inch refractor. Limiting completeness magnitude ~7.5.

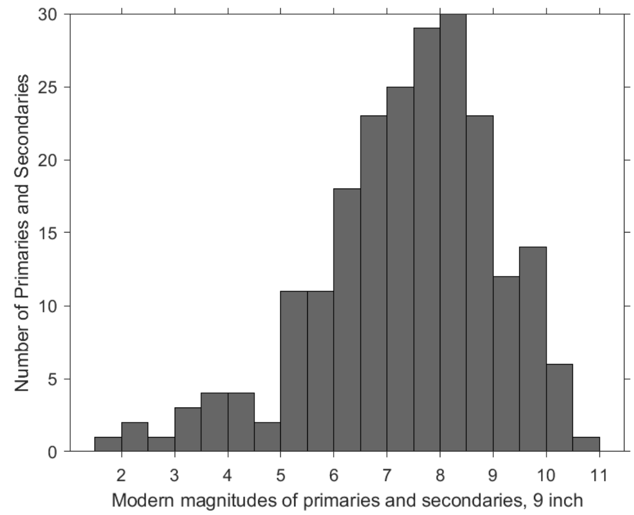

Figure 16: Histogram of modern magnitude measures of primary and secondary components observed with 9 inch reflector. Limiting completeness magnitude ~8.

¼ inch refractor and ~8 through the 9 inch reflector. We of course use the word "completeness" cautiously. There is no suggestion that Dunlop either intended to or wanted to find every southern double star brighter than ~8.

5. Omissions in the WDS

In the course of our investigation, we identified 13 real doubles first discovered by Dunlop but are not in the WDS, namely those indicated by "two" in Column 2 of the Appendix: 35*, 37, 100, 107, 112*, 118, 119*, 149*, 153*, 164*, 167, 198, 252*. See Dunlop Paper II (Letchford, White and Ernest, Paper II, IN PRINT). We offer the data on these pairs in our Appendix for possible inclusion in a future edition of the WDS.

6. Conclusion

A summary of our accuracy estimations for Dunlop are given in the appropriate sections above. The Appendix of this paper (Dunlop Paper III) contains a modern Catalogue of the Dunlop doubles. The Appendix associated with Dunlop Paper II contains modern Identifications of the Dunlop doubles.

Our analysis shows that Herschel's criticisms of Dunlop's Double Star Catalogue Dunlop Paper I (Letchford, White and Ernest, Paper I, IN PRINT) were unjustified, except when it came to separation and perhaps to his magnitude estimates.

7. Acknowledgements

We acknowledge the following:-

- The Aladin sky atlas developed at CDS, Strasbourg Observatory, France.
- The Washington Double Star Catalog maintained by the USNO. (WDS)
- All-sky Compiled Catalogue of 2.5 million stars, 3rd version (ASCC)
- The Gaia Catalogue (Gaia DR2, Gaia Collaboration, 2018), from VizieR (GAIA DR2).

8. References

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Appendix
Modern Version of the Dunlop Catalogue

(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
1*	00 31 32.664	-62 57 29.52	00315-6257	LCL 119AC	168.877	27.150	4.329	4.504	B9V	A2V	-54.577	-54.577	105.607	-48.057
2*	00 52 24.528	-69 30 13.68	00524-6930	DUN 2	80.817	20.303	6.646	7.317	F7IV/V	G1V	-67.462	-67.462	9.966	-79.096
3	01 26 58.104	-32 32 35.52	01270-3233	LDS 2199			6.681		C6.5II		-30.900	-30.900		
4*	01 38 48.552	-53 26 20.04	01388-5327	DUN 4	104.038	10.389	7.092	8.425	F5IV/V	F5	-48.180	-48.180	-8.577	-46.990
5*	01 39 47.808	-56 11 35.88	01398-5612	DUN 5	190.175	11.338	5.682	5.835	K0V	K0V	15.333	15.333	309.102	10.686
6	02 16 30.600	-51 30 43.92	02165-5131	DUN 6AB	223.979	89.051	3.546	9.338	B8IV-V		-22.854	-22.854	-0.643	12.013
7	02 39 39.840	-59 34 03.00	02397-5934	DUN 7A,BC	96.722	36.906	7.587	7.665	G8/K0III	A9IV	0.287	0.287	19.15 A	-0.2 A
8*	02 57 14.688 A	-24 58 09.84 A	02572-2458	S 423AB,C	224.598	28.818	7.613	7.795	K1/K2V	K2V	33.47 A	-36.31 A	1.073	-40.460
9*	02 58 15.672	-40 18 16.92	02583-4018	PZ 2	90.000	8.511	3.211	4.278	A4III+...	A1V	23.503	23.503	-51.661	16.178
10	03 04 33.144	-51 19 19.56	03046-5119	DUN 10AB	69.397	39.898	7.540	8.498	G1V	K0	71.856	71.856	86.5 A	71.72 A
11			unidentified											
12	03 15 11.040	-64 26 38.04	03152-6427	DUN 12A,BC	105.378	19.006	6.617	8.887	F5M	F5	-57.011	-57.011	-24.461	-60.221
13*			unidentified											
14	03 38 10.248	-59 46 35.04	03382-5947	DUN 14	271.795	57.473	6.951	8.302	F3V	F5V	43.356	43.356	25.698	44.655
15*	03 39 45.480	-40 21 07.92	03398-4022	DUN 15	327.582	7.676	6.901	7.752	A3V		18.996	18.996	21.711	10.570
16*	03 48 35.880	-37 37 12.72	03486-3737	DUN 16	216.799	8.093	4.709	5.300	B8	A1V	-5.007	-5.007	63.251	-8.658
17*	04 00 59.376	-54 23 31.56	04010-5424	DUN 17AB	141.883	64.518	7.677	8.173	A3V	A9III/IV	17.142	17.142	29.236	-6.599
18*	04 50 55.320	-53 27 41.40	04509-5328	DUN 18AB	58.325	12.340	5.606	6.342	F0IV...	F0IV	66.139	66.139	-80.769	85.658
19*	05 16 23.832	-33 32 16.08	one				6.947		K0III		-14.998	-14.998		
20*	05 24 46.272	-52 18 59.04	05248-5219	DUN 20AB,C	288.734	38.110	6.234	6.761	A0V	A2V	-5.23 A	-27.93 A	-7.188	-28.139
21	05 30 09.480	-47 04 39.72	05302-4705	DUN 21AD	271.461	197.665	5.455	6.638	G3IV	F2V	-132.345	-132.345	28.157	-0.165
22*	05 31 10.440	-42 17 59.28	05312-4219	DUN 22	167.489	7.375	6.131	7.789	A5	A7/F0V+(F	59.768	59.768	31.348	66.174
23	06 04 46.680	-48 27 29.88	06048-4828	DUN 23	121.097	2.788	6.969	7.570	G6V		-22.693	-22.693	-117.386	-39.041
24	06 10 17.904	-54 58 06.96	one				4.717		B0.5IV		7.634	7.634		
25	06 18 53.184	-32 12 06.12	06189-3212	JSP 96	9.605	1.826	9.446	10.159	K0		9.365	9.365	11.079	8.378
26*	06 12 11.232	-65 31 52.32	06122-6532	DUN 26AB	119.394	20.537	6.800	8.071	F6V	F7IV	154.474	154.474	18.163	143.919
27*	06 16 18.792	-59 12 48.60	06163-5913	DUN 27AB	232.931	34.640	6.421	7.638	G1V	F3/F5V	-316.585	-316.585	26.814	-209.198
28*	06 24 01.008	-36 42 28.08	06240-3642	DUN 28AC	74.229	63.579	5.617	6.822	K1II/III	G6/G8III	55.014	55.014	-25.344	-5.049
29*	06 29 07.104	-40 22 18.84	06291-4022	DUN 29	117.927	64.567	7.556	7.862	K2IV/V	K0PBA	25.845	25.845	-11.053	1.190
30	06 29 49.128 A	-50 14 20.40 A	06298-5014	DUN 30AB,CD	312.678	12.215	5.297	9.173	F2V		-53.31 A	-60.9 A	-67 A	-52.4 A

Modern Version of the Dunlop Catalogue (continued)
(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
31*	06 38 37.632	-48 13 12.72	06386-4813	DUN 31	321.026	12.966	5.027		G8III		20.104	20.104	5.297	18.934
32*	06 42 16.392	-38 23 55.68	06423-3824	DUN 32	277.785	7.973	6.501	5.762	A3V+...	A3	3.682	3.682	-13.959	2.181
33	06 46 03.216	-39 32 25.08	one				6.626		B4Vne		8.125	8.125		
34*	06 44 12.792	-54 41 43.80	06442-5442	DUN 34	191.598	129.361	6.473	6.672	B5/B6V	B8/B9V	5.979	5.979	-8.861	14.066
35*	06 48 43.128	-43 48 05.40	two		270.535	269.972	7.328	7.407	B8V	A4V	10.642	10.642	-13.571	41.058
36*	06 50 23.352	-31 42 21.96	06504-3142	H 5 108A,BC	65.605	42.710	5.735	7.735	B3V	F3	15.219	15.219	-2.053	14.232
37	07 01 18.288	-50 28 00.12	two		74.081	483.010	7.234	7.592	B8III	B9V	3.492	3.492	-5.041	1.900
38*	07 03 57.312	-43 36 28.80	07040-4337	DUN 38AB	125.024	21.327	5.534	6.691	G3V...	K0V	389.550	389.550	-101.764	382.276
39*	07 03 15.096	-59 10 41.16	07033-5911	DUN 39	90.000	1.476	5.697	6.789	B9IV		12.429	12.429	-17.013	10.128
40*	07 09 13.800	-56 21 36.36	07092-5622	DUN 40	142.548	36.732	8.010	8.439	G8/K0III	F0III	3.274	3.274	-9.964	1.587
41	07 10 24.480	-55 35 15.72	07104-5536	RMK 5	225.262	7.160	7.590	7.725	G8/K0III+G/K		-11.968	-11.968	0.404	-11.671
42*	07 08 44.856	-70 29 56.04	07087-7030	DUN 42	297.632	13.972	3.756	5.548	G8IIIvar	F0/3	106.881	106.881	5.938	112.927
43*	07 17 08.568	-37 05 51.00	07171-3706	DUN 43AB	213.346	68.952	2.710	7.921	K3Ib	B9/A0(V)	2.283	2.283	-9.960	6.374
44	07 20 21.432	-52 18 41.40	unidentified	RMK 6	25.569	9.179	5.965	6.534	F0-2IV-V	F9Ve+K3V+	148.387	148.387	-34.085	137.956
45*	07 21 22.152	-48 31 37.56	07214-4832	DUN 45	157.097	22.667	6.787	7.862	B9V	B8IV/V+...	23.524	23.524	-10.307	24.127
46			unidentified											
47	07 24 43.848	-31 48 32.04	07247-3149	DUN 47A,CD	343.044	98.607	5.328	7.584	K1III	B8V	9.185	9.185	-7.720	5.415
48*			unidentified											
49	07 28 51.144	-31 50 54.24	07289-3151	DUN 49	53.655	9.112	6.372	7.044	B3V+...	B4V	4.058	4.058	-10.264	5.200
50			unidentified											
51	07 29 13.848	-43 18 05.04	07292-4318	DUN 51	73.723	21.835	3.260	9.491	K5IIISB	G5V	174.579	174.579	-63.322	189.489
52*	07 34 18.624	-23 28 25.32	07343-2328	H N 19	116.711	9.611	5.771	5.816	F6V	F5/7V	-0.739	-0.739	-87.414	-11.691
53*	07 38 49.872	-26 48 13.68	07388-2648	H 3 27AB	316.857	9.868	4.441	4.651	B5IV	B6V	21.357	21.357	-22.705	12.708
54*	07 45 15.288	-37 58 06.96	one				3.621		K4III		4.903	4.903		
55*	07 44 12.504	-50 27 24.12	07442-5027	DUN 55AC	133.302	51.965	6.629	7.528	F8V	G0	143.459	143.459	-111.783	142.603
56*	07 47 07.200	-41 30 13.32	07471-4130	DUN 56	178.135	49.706	6.916	7.692	B1/B2Ib/II	K7III	5.205	5.205	-6.212	3.664
57	07 41 49.272	-72 36 21.96	07418-7236	DUN 57	118.244	16.736	3.947	9.307	K0III		16.213	16.213	27.817	28.001
58	07 54 44.736	-44 21 20.88	three		159.506	84.551	7.171	7.842	B8II/III	B8II	4.445	4.445	-5.367	4.836
59	07 59 12.312	-49 58 36.84	07592-4959	DUN 59AB	47.169	16.416	6.296	6.318	B2IV-V	B2IV-V	8.398	8.398	-5.623	7.875
60	08 01 23.040	-54 30 55.80	08014-5431	DUN 60	162.251	40.445	6.113	7.986	B2IV-V	A8	6.417	6.417	-3.302	5.025
61	08 06 51.528	-27 06 51.48	08069-2707	DUN 61	34.767	69.679	7.051	8.925	B7III	K0	1.606	1.606	-17.806	-5.395
62*	08 04 42.936	-62 50 10.68	08047-6250	DUN 62	259.185	86.339	6.244	7.677	B2.5Vn	M	11.960	11.960	11.144	-46.039
63*	08 09 47.688	-42 38 26.88	08098-4238	DUN 63	82.623	5.608	6.477	7.473	B7V		5.598	5.598	-10.314	7.716
64*	08 09 31.944 A	-47 20 11.76 A	08095-4720	DUN 65AC	152.008	62.377	1.812	7.288	WC8+O9I	F0	-5.94 A	13.19 A	-6.725	9.203
65*	08 09 31.944 A	-47 20 11.76 A	08095-4720	DUN 65AB	220.333	41.087	1.812	4.199	WC8+O9I	B2III*	-5.94 A	13.19 A	-6.706	10.775
66*	08 07 55.800	-68 37 01.56	08079-6837	RMK 7	23.411	6.277	4.390	7.296	B6IV		29.553	29.553	-30.036	29.584
67	08 13 58.320	-36 19 20.28	08140-3619	DUN 67	176.014	66.761	5.074	6.073	B2V:	B2IV/V	7.093	7.093	-6.904	7.598
68	08 13 18.192	-36 20 30.12	08136-3621	DUN 68	25.579	124.924	7.294	7.322	B5V	B2/B3V	7.279	7.279	-7.425	7.218
69	08 25 31.320	-51 43 38.64	08255-5144	DUN 69AB	218.143	25.634	5.165	9.626	B2V		17.555	17.555	-6.649	7.502
70*	08 29 27.480	-44 43 29.28	08295-4443	DUN 70	350.689	4.742	5.162	6.972	B3Vn		8.166	8.166	-6.480	7.339
71	08 30 34.416	-40 30 42.12	08306-4031	DUN 71	51.516	63.636	7.034	7.500	B8V	K4III	5.500	5.500	4.444	-11.887
72	08 40 21.120	-42 23 21.12	08404-4223	DUN 72A,BC	359.765	129.601	6.863	7.704	A3V	(G)	37.681	37.681	0.751	6.163
73*	08 56 11.256	-55 31 41.88	08562-5532	DUN 73AB	0.177	65.880	7.689	8.152	K0	K0	6.848	6.848	1.675	6.021
74*	08 56 58.416	-59 13 45.48	08570-5914	DUN 74	75.957	40.059	4.897	6.692	B2IV-V	B9.5V	8.421	8.421	-10.283	8.077
75	09 17 54.984	-69 48 16.92	09179-6948	RMK 10	18.412	10.624	8.142	8.515	A0V:	A0	6.229	6.229	-7.509	6.167

Modern Version of the Dunlop Catalogue (continued)
(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
76*	09 28 34.176	-45 29 51.72	09286-4530	DUN 76AC	99.232	60.589	7.125	7.594	B6Vnn	B5IV/V	-2.923	-2.923	-9.745	-0.649
77	09 29 18.672	-44 32 20.40	09293-4432	DUN 77AB	77.363	108.606	7.006	6.968	G0V...	F8V	8.244	8.244	-113.311	16.341
78*	09 30 46.104	-31 53 21.12	09308-3153	DUN 78	212.031	8.068	6.155	6.879	A1V	A1V	-22.448	-22.448	20.756	-21.530
79*	09 33 38.688	-49 45 28.44	09336-4945	DUN 79	33.023	140.401	7.340	7.522	K0III	G6IV	-34.944	-34.944	53.565	-1.471
80	09 45 03.672	-49 29 07.44	09450-4929	DUN 80AB	249.970	18.919	8.020	8.111	F8/G0V	G0/G1IV/V	98.409	98.409	-23.581	97.158
81	09 54 17.664	-45 17 00.60	09543-4517	DUN 81	239.103	5.609	5.787	8.220	B4V	B9V	5.356	5.356	-15.021	2.722
82	09 33 17.640	-86 00 36.36	09333-8601	DUN 82	275.093	16.221	7.083	7.554	F3/F5IV+...	F2	-23.253	-23.253	-50.4 A	-19.98 A
83	10 02 05.736	-54 58 53.76	10021-5459	DUN 83	226.680	113.864	7.748	7.896	K2III	B8/B9V	-12.832	-12.832	-13.764	0.217
84*	10 03 10.440	-52 02 46.68	10032-5203	HJ 4282	194.518	49.459	7.346	8.345	A4/5IV/V	B9	38.332	38.332	-15.952	0.794
85	10 28 48.504	-62 35 02.40	10288-6235	DUN 85	220.392	21.743	8.310	8.770	B6V	B5/7	4.159	4.159	-14.348	4.276
86*	10 31 13.320	-42 13 45.84	10312-4214	DUN 86AB	291.461	83.636	7.343	8.015	APEUCR (SR)	A1V	-7.451	-7.451	-13.416	-5.012
87*	10 30 39.240	-61 21 23.40	10307-6121	DUN 87	331.134	82.215	6.427	7.558	M2III	B4:V:ne	12.591	12.591	-8.881	3.456
88*	10 31 57.432	-45 04 00.12	10320-4504	PZ 3	217.844	13.676	5.701	6.052	B6II	B8II	-1.435	-1.435	-15.865	-2.876
89*	10 33 15.144	-55 23 12.84	10333-5523	DUN 89AB	30.385	25.874	6.676	7.722	G5	A1V	-0.886	-0.886	-13.670	-3.012
90			unidentified											
91*	10 31 55.368	-72 06 38.16	10319-7207	DUN 91	61.822	9.911	8.512	8.810	B8/9V		2.594	2.594	-5.986	2.320
92*	10 32 01.464	-61 41 07.08	one				3.359		B4Vne		7.607	7.607		
93*	10 34 56.472	-64 08 02.40	10349-6408	DUN 93AB	39.427	24.235	7.425	8.338	A0V	A9III	11.672	11.672	-17.395	2.221
94*	10 38 45.000	-59 10 58.80	10387-5911	DUN 94	20.681	14.622	4.702	7.464	K4/K5III:	B9II/III	1.117	1.117	-14.380	0.932
95*	10 39 18.384	-55 36 11.88	10393-5536	DUN 95AB	105.293	51.866	4.276	6.179	G2II	B8V	4.880	4.880	-19.178	5.524
96*	10 42 40.560	-59 12 56.88	one				5.392		B2.5Ia		2.484	2.484		
97	10 43 09.432	-61 10 06.60	10432-6110	DUN 97AB	174.491	12.658	6.592	7.909	B3III	A0III:	2.907	2.907	-14.740	3.370
98*	10 45 03.528	-59 41 04.20	10451-5941	DUN 98AH	17.143	61.032	6.369	8.123	PECULI-ARE	O3V	-10.86 A	3.86 A	-6.547	2.145
99*	10 44 20.016	-70 51 34.92	10443-7052	DUN 99AB	75.341	62.591	6.237	6.441	A5IV/V	A6IV	-0.080	-0.080	-47.578	0.999
100	10 46 16.536	-64 30 52.56	two		157.027	396.093	5.327	8.414	B7:V	F7V	10.854	10.854	-84.929	20.375
101	10 50 58.632	-59 57 26.28	10510-5957	HJ 4378	346.914	31.046	6.787	10.173	B8/B9IV		-0.965	-0.965	-6.335	1.880
102*	10 53 29.664	-58 51 11.52	10535-5851	DUN 102AB	204.434	159.352	3.776	6.244	K0III-IV...	B5V	39.426	39.426	-15.284	2.841
103*	10 53 29.664	-58 51 11.52	10535-5851	DUN 103AC	6.994	56.581	3.776	7.842	K0III-IV...		39.426	39.426	19.485	-14.069
104	11 00 08.280	-51 49 04.08	three				6.150		A3III/IV		1.694	1.694		
105*	11 04 55.512	-61 03 05.76	11049-6103	DUN 105	221.378	23.988	7.597	9.819	O9V		1.404	1.404	-6.582	1.574
106	11 17 12.000	-38 00 51.84	one				6.231		A1V		8.975	8.975		
107	11 18 41.688	-74 11 26.16	two		299.644	123.005	7.730	8.562	F7IV/V	APSI	-14.419	-14.419	-13.052	1.635
108	11 22 15.576	-58 23 09.60	four				6.631		G8III		-47.996	-47.996		
109*	11 28 35.088	-42 40 27.12	11286-4240	BSO 6	169.585	13.177	5.131	7.513	B9V	A3V	9.153	9.153	-34.534	12.493
110	11 29 54.960	-55 19 07.68	three				7.775		K2/4		-4.802	-4.802		
111*	11 32 16.416	-29 15 39.60	11323-2916	H 3 96	211.253	9.686	5.619	5.723	F8V	F3/5	144.524	144.524	-22.025	139.982
112*	11 35 58.920	-50 44 32.64	two		288.907	209.980	7.791	8.121	F0/F2V	A5V	11.378	11.378	-28.678	-1.658
113*	11 36 58.008	-38 57 34.20	11370-3858	DUN 113	149.285	149.072	6.941	7.465	A0/A1V	K2III	-2.705	-2.705	50.376	-17.133
114	11 39 58.488	-38 06 30.24	11400-3806	DUN 114	94.843	17.057	6.618	8.168	G8III	K5	-18.768	-18.768	-51.558	-17.676
115	11 39 57.024	-33 26 59.64	11400-3327	I 232	146.277	2.164	6.875	10.034	K1III		-26.794	-26.794	-48.15 A	-27.04 A
116*	11 56 43.776	-32 16 02.64	11567-3216	DUN 116AB	261.184	18.791	7.749	7.697	G3V	G3V	-6.668	-6.668	-171.610	-8.250
117*	12 04 46.968	-61 59 48.48	12048-6200	DUN 117AB	149.500	22.980	7.380	7.631	B8Ib-II...	F0Ib-II	-0.065	-0.065	-6.532	0.151
118	12 12 52.104	-59 39 19.08	two		125.565	58.801	7.054	8.479	K0III	K0III	0.265	0.265	-8.491	-0.107
119*	12 14 17.040	-66 32 55.32	two		32.176	102.503	7.119	7.433	B5V	B0.5Ib	0.312	0.312	-5.490	-0.532
120*			unidentified											

Modern Version of the Dunlop Catalogue (continued)
(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
121			unidentified											
122*	12 26 35.952 A	-63 05 56.76 A	12266-6306	DUN 252AC	202.454	89.982	1.039	4.795	B0.5IV	B3/5V	-35.56 A	-13.9 A	-39.591	-14.537
123*	12 26 35.952 A	-63 05 56.76 A	12266-6306	DUN 252AB	111.026	4.014	1.039	1.570	B0.5IV	B1V	-35.56 A	-13.9 A	-42.52 A	-7.67 A
124*	12 31 09.936 A	-57 06 45.36 A	12312-5707	DUN 124AB	26.149	125.527	1.656	6.402	M4III	A3V	26.55 A	-263.85 A	2.317	-21.349
125*	12 47 43.320 A	-59 41 19.32 A	12477-5941	DUN 125AC	22.836	372.650	1.294	7.177	B0.5III	B7II	-47.77 A	-12.97 A	-10.676	-2.082
126*	12 54 35.616	-57 10 40.44	12546-5711	DUN 126AB	17.341	34.697	3.993	5.096	B2IV-V	B5Vne	-14.510	-14.510	-28.155	-10.343
127*	12 59 48.312	-55 54 44.28	12598-5555	DUN 127	125.717	16.650	8.222	8.942	B7IV/V	B9	-4.565	-4.565	-15.511	-4.833
128	13 06 54.648	-49 54 22.68	13069-4954	DUN 128	99.153	24.894	4.269	10.012	B1.5V	F5V	-10.580	-10.580	-27.853	-12.561
129*	13 08 07.152	-65 18 21.60	13081-6518	RMK 16AB	186.357	5.433	5.649	7.552	WC6+O9.5I	O9.5II	-1.649	-1.649	-3.926	-1.944
130			unidentified											
131*	13 15 14.928	-67 53 40.56	13152-6754	DUN 131AC	331.252	58.307	4.775	7.250	B8V	F0	-9.652	-9.652	-30.949	-11.420
132*			unidentified											
133*	13 22 37.920	-60 59 18.24	13226-6059	DUN 133AB,C	345.647	60.571	4.508	6.185	B3V	B4Vn	-23.842	-23.842	-10.259	-9.996
134	13 20 35.808	-36 42 44.28	one				2.743		A2V		-82.181	-82.181		
135	13 22 55.632	-62 00 43.92	five				7.953		A0Ia		-1.713	-1.713		
136	13 31 02.640	-39 24 26.64	13310-3924	SEE 179	188.949	573.987	3.890	8.192	G8II/III	M2III	-14.71 A	-11.52 A	-3.130	-10.911
137*	13 32 03.912	-63 02 30.84	13321-6303	DUN 137	357.640	15.853	7.478	8.484	B0.5III:		-1.999	-1.999	-3.534	-2.895
138*	13 36 48.456	-26 29 42.72	13368-2630	H N 69AB	190.856	10.264	5.714	6.578	A7V+...	A2	16.448	16.448	-84.974	14.125
139	13 36 54.840	-56 09 24.48	three				8.012		G6V		-44.774	-44.774		
140	13 45 47.280	-71 59 04.92	13458-7159	DUN 140	72.798	10.956	8.708	9.656			-8.391	-8.391	-14.223	-7.738
141*	13 41 44.760	-54 33 33.84	13417-5434	DUN 141	162.815	5.652	5.193	6.511	B8Vn+...	A0V	-24.437	-24.437	-42.883	-27.608
142*	13 43 57.336	-59 14 09.60	13440-5914	DUN 142	90.000	33.330	6.487	7.702	B8V	B9V	-10.603	-10.603	-31.023	-10.321
143	13 49 14.256	-62 06 11.88	13492-6206	DUN 143	37.173	13.102	7.508	7.986	K2/K3II/III	B2II:	-6.595	-6.595	-5.477	-2.875
144	13 49 34.392	-47 22 09.48	13496-4722	DUN 144	256.175	9.039	8.208	8.954	F6V+F7/G0		6.117	6.117	52.444	5.605
145	13 54 37.512	-66 54 03.96	13546-6654	DUN 145	48.327	23.824	7.796	8.906	B9V	F0	-22.574	-22.574	-13.657	-12.284
146*	13 49 16.488	-40 30 59.04	13493-4031	DUN 146	86.606	66.895	6.920	7.316	F3V	M1III	2.347	2.347	-0.203	-1.343
147*	13 52 04.872	-52 48 41.40	13521-5249	RMK 18	288.525	18.130	5.250	7.469	B9Vn	B8V	-27.426	-27.426	-40.104	-27.611
148*	13 51 49.608	-32 59 38.76	13518-3300	H 3 101	105.968	7.852	4.528	5.974	B5III	B8V	-27.909	-27.909	-36.737	-23.774
149*	13 53 32.712	-38 15 57.60	two		216.219	179.384	7.636	8.286	A4III/IV	K1III/IV	-24.703	-24.703	-66.165	-10.121
150	13 57 28.080	-57 42 39.96	13575-5743	DUN 150AB	265.774	58.621	7.367	8.767	M3Iab/Ib	B7III	-1.534	-1.534	-2.879	-3.765
151	13 57 17.232	-56 02 24.00	13573-5602	DUN 151	54.766	36.192	7.515	8.934	G2V	A2	-84.789	-84.789	-16.026	-0.664
152	14 01 43.512	-45 36 12.24	one				4.331		F6II		-26.805	-26.805		
153*	14 06 02.760	-41 10 46.56	two		78.065	85.298	4.348	8.482	B2V	A1Vn	-20.186	-20.186	-23.419	-21.649
154	14 05 30.336	-36 32 42.72	14055-3633	DUN 154	129.942	20.747	8.208	9.880	A9V		-7.915	-7.915	-14.112	-7.548
155*	14 07 44.568	-53 41 27.96	14077-5341	DUN 155	6.623	18.483	7.849	8.397	F2	F0V+...	-2.392	-2.392	-54.572	-18.304
156	14 06 41.328 A	-36 22 07.32 A	14067-3622	DUN 253AB			2.058		K0IIIb		-519.66 A	-518.73 A		
157	14 09 35.040	-51 30 16.92	14096-5130	HJ 4651	130.526	64.267	5.956	8.722	B9IV	K2III	-12.572	-12.572	-14.853	-3.199
158			unidentified											
159*	14 22 37.008	-58 27 32.40	14226-5828	DUN 159AB	155.406	9.502	4.914	7.151	G8/K1+F/G		-46.45 A	31.37 A	-39.632	24.115
160*	14 26 08.232	-45 13 17.04	14261-4513	DUN 160	204.036	156.883	4.552	8.928	B2IV		-14.308	-14.308	-15.266	0.872
161	14 15 38.688	-45 00 02.88	one				6.306		F9V		-137.455	-137.455		
162	14 33 51.696	-46 27 53.64	14339-4628	DUN 162			7.188		G6/G8III		-35.452	-35.452		
163*	14 38 00.576	-54 30 40.68	14380-5431	DUN 163	103.290	64.209	7.991	8.364	F0III	B8III	-34.664	-34.664	-6.285	-7.422
164*	14 35 30.384	-42 09 28.80	two		141.555	129.621	2.328	9.192	B1Vn+A	A5V	-35.29 A	-34.59 A	4.847	-1.749
165*	14 39 40.896 A	-60 50 06.36 A	14396-6050	RHD 1AB	214.906	19.315	-0.008	1.348	G2V	K1V	-3678.16 A	481.82 A	-3600.35 A	952.09 A

Modern Version of the Dunlop Catalogue (continued)
(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
166	14 42 30.408	-64 58 30.36	14425-6459	DUN 166AB	226.218	15.609	3.174		F1Vp		-232.614	-232.614	-170.705	-250.314
167	14 41 01.392	-36 08 05.64	two		148.149	82.644	5.659	9.331	APSI	F0V	-6.363	-6.363	-31.616	-8.199
168	14 42 46.512	-55 10 54.48	14428-5511	DUN 168	200.839	5.778	8.430	8.659	F3+FIII		-13.473	-13.473	6.736	-13.343
169*	14 45 10.968	-55 36 05.76	14452-5536	DUN 169	105.433	68.993	6.090	7.486	B2III	K2III	-7.221	-7.221	2.470	-6.707
170			unidentified											
171	14 53 22.128	-45 51 20.88	14534-4551	DUN 171AB	228.203	17.825	7.086	9.496	B3Ve	B8	-2.830	-2.830	-10.654	-0.452
172	14 54 42.576	-65 59 27.96	one				6.074		B3Vn		-8.510	-8.510		
173	14 52 51.072	-37 48 11.52	14529-3748	SHT 57			5.014		B7II/III		-20.118	-20.118		
174*	14 55 18.960	-46 37 52.68	one				7.296		G6III		-25.563	-25.563		
175	15 01 56.928	-51 55 05.88	15019-5155	HJ 4723AB	168.382	5.513	7.436	9.937	G8/K0III		-21.908	-21.908	-35.634	-21.738
176*	15 12 17.088	-52 05 57.12	15123-5206	DUN 176	248.789	71.640	3.398	6.670	G8III	F8V	-72.951	-72.951	-111.478	-69.076
177*	15 11 56.088	-48 44 16.08	15119-4844	DUN 177	143.582	26.395	3.848	5.613	B9V	A3IV	-51.638	-51.638	-98.451	-43.845
178*	15 11 34.800	-45 16 39.00	15116-4517	DUN 178AC	258.524	30.760	6.415	7.293	K1III	K0III	14.346	14.346	34.467	-47.458
179*	15 14 30.984	-43 23 13.20	15145-4323	DUN 179	46.499	10.460	7.301	8.477	A1V+B/A		-15.529	-15.529	-6.984	-15.199
180*	15 18 31.968 A	-47 52 30.00 A	15185-4753	DUN 180AC	130.523	23.825	5.005	6.619	B8	A2/A3V:	-26.54 A	-44.34 A	-18.595	-24.721
181	15 20 14.112	-38 22 43.32	15202-3823	DUN 181AB	350.769	29.907	9.550	10.109	B9V		-6.713	-6.713	7.027	-0.474
182*	15 22 40.872	-44 41 22.56	15227-4441	DUN 182AC	168.829	26.421	3.369		B2IV-V		-24.139	-24.139	-6.461	-13.865
183*	15 25 20.208	-38 44 00.96	15253-3844	DUN 183AB	203.821	92.478	4.597	9.286	A0V	G5V	-24.603	-24.603	-39.517	-43.507
184	15 26 15.264	-42 51 44.28	15263-4252	DUN 184	96.807	21.260	8.388	9.432	G0V		-29.764	-29.764	-6.436	-6.703
185	15 28 27.216	-51 35 52.44	15285-5136	SEE 234			6.090		G2Ib		-5.219	-5.219		
186	15 33 04.800	-58 11 38.76	15331-5812	DUN 186	114.903	39.327	8.762	8.682	F3IV	F3/F5V	-62.513	-62.513	-42.649	-61.069
187	15 33 33.264	-47 32 16.08	15336-4732	DUN 187	218.746	24.464	7.126	9.347	F0IV		-69.183	-69.183	26.510	-70.857
188	15 36 43.224	-66 19 01.20	15367-6619	DUN 188	219.956	82.187	4.102	9.295	K0III	A8/F0IV/V	-55.113	-55.113	-10.660	-11.821
189	15 38 49.464	-52 22 21.72	15388-5222	DUN 189AB	278.958	53.178	5.421	10.564	B9V		-31.787	-31.787	-34.663	-31.194
190	15 42 58.248	-58 06 52.92	15430-5807	DUN 190AB	90.000	4.944	7.859	9.694	M3III+...	B8/A0(III)	-2.815	-2.815	-5.770	-4.106
191	15 45 16.224 A	-58 41 13.56 A	15453-5841	DUN 191AB,C	296.260	32.546	7.672	8.079	G6III+...	A4V	9.84 A	2.05 A	8.914	1.473
192	15 47 04.464	-35 30 37.08	15471-3531	DUN 192AB,C	143.109	34.660	6.848	7.309	A0V	B9.5V	-25.639	-25.639	-18.870	-24.999
193	15 51 06.816	-55 03 19.80	15511-5503	DUN 193	11.766	16.180	5.763	8.932	B2II		-3.891	-3.891	-28.427	-36.475
194	15 54 52.632	-60 44 37.32	15549-6045	DUN 194AC	47.413	44.687	6.227	9.956	B9II		-3.844	-3.844	-3.699	-6.224
195	15 54 50.472	-50 20 17.88	15548-5020	DUN 195AB	8.796	12.021	6.777	7.480	A3/5V+B/A		-40.644	-40.644	-37.997	-39.871
196*	15 56 53.496	-33 57 57.96	15569-3358	PZ 4	50.147	10.112	5.087	5.568	A3V	B9V	-37.981	-37.981	10.821	-41.299
197*	16 00 07.320	-38 23 48.12	16001-3824	RMK 21AC	247.730	114.942	3.414	9.319	B2.5IV	G0V	-28.463	-28.463	-18.187	-26.577
198	16 04 21.312	-53 42 37.44	two		190.814	80.632	6.474	9.734	B9II/IIIp..	A2	-11.037	-11.037	-4.952	-7.694
199	16 08 34.560	-39 05 34.44	16086-3906	DUN 199AC	184.003	44.027	6.632	7.084	A1/A2III	A7IVe	-19.959	-19.959	-8.950	-23.007
200	16 22 29.064	-43 54 43.56	16225-4355	DUN 200	194.980	39.130	5.907	9.541	G2Ib		-12.758	-12.758	1.414	0.848
201	16 27 57.336	-64 03 28.44	16280-6403	DUN 201	2.178	16.572	5.283	9.649	F4IV		26.065	26.065	-1.072	-4.837
202	16 31 41.760	-41 49 01.56	16317-4149	DUN 202AC	178.674	57.976	5.316	9.595	B1Ia		-2.340	-2.340	2.735	-2.578
203	16 33 05.160	-60 54 12.96	16331-6054	DUN 203	277.439	22.245	7.886	8.157	A3III	F8/G0V	-22.679	-22.679	58.938	79.868
204	16 35 13.848	-35 43 28.56	one				6.627		B9V		-25.699	-25.699		
205			unidentified											
206	16 41 20.424	-48 45 46.80	16413-4846	DUN 206A,C	265.768	9.756	5.668	6.755	O5V:+O6:	O7V	-4.439	-4.439	1.270	-3.724
207	16 44 25.584	-42 23 34.80	16444-4224	DUN 207	185.274	11.569	8.970	9.585	G8III/IV	A3/5	-46.216	-46.216	-13.169	-46.250
208	16 43 44.376	-47 06 20.52	one				7.064		APSI		-16.278	-16.278		
209	16 48 11.328	-36 53 02.40	16482-3653	DUN 209	138.658	23.975	7.473	8.347	A5IV/V	A0/1	0.613	0.613	6.192	9.153
210	16 48 42.816	-55 26 01.68	16487-5526	DUN 210AB	351.315	75.749	8.161	8.647	K	APSI	-16.215	-16.215	-2.430	-8.239

The Southern Double Stars of James Dunlop III: Modern Version and Analysis of Accuracy ...

Modern Version of the Dunlop Catalogue (conclusion)
(See Table 1 Section 2, for explanation of columns)

DUN	RA h:m:s	DE d:m:s	WDS	Disc	PA deg	Sep as	Vmag1	Vmag2	SpType1	SpType2	pmRA1 mas/yr	pmDE1 mas/yr	pmRA2 mas/yr	pmDE2 mas/yr
211	16 47 36.864	-48 20 11.40	16475-4819	DUN 211BC	193.482	45.165	8.121	8.168	F3/8(III)	F2/3IV/V	-36.729	-36.729	-5.591	-37.335
212	17 04 01.224	-51 05 00.96	17040-5105	DUN 212AB	282.812	16.234	8.340	8.810	B2V	B3V	-2.641	-2.641	-1.042	-4.664
213	17 10 20.832	-46 44 18.24	17103-4644	DUN 213	166.006	8.162	6.883	8.270	B1Ib		-3.170	-3.170	0.542	-5.519
214	17 13 17.880	-67 11 47.76	17133-6712	DUN 214AB	14.005	37.474	5.872	8.746	K0III-IV		-89.998	-89.998	-9.949	-9.580
215	17 19 19.776	-53 23 08.88	17193-5323	DUN 215AB	43.082	61.612	8.317	8.925	K1III	F3/F5V	-176.351	-176.351	-46.609	-70.485
216*	17 26 51.984	-45 50 34.80	17269-4551	DUN 216AC	311.954	102.852	5.502	7.102	B8V	A0V	-28.278	-28.278	-5.906	-29.375
217	17 29 00.864	-43 58 26.04	17290-4358	DUN 217	167.924	13.621	6.293	8.503	B5III		-11.042	-11.042	-2.767	-8.684
218	17 33 36.528 A	-37 06 13.32 A	17336-3706	DUN 218AC	329.789	94.148	1.623	9.121	B1.5IV+...		-4.94 A	-29.7 A	-5.037	-31.096
219	17 58 55.680	-36 51 30.24	17589-3652	DUN 219AB	254.228	52.978	5.734	7.718	G8III	F0IV/V	13.942	13.942	-21.464	-45.722
220	18 22 09.912	-55 33 51.12	18222-5534	DUN 220	176.989	31.003	8.022	8.420	F8/G0		1.586	1.586	79.534	1.748
221	18 24 18.240	-44 06 37.08	18243-4407	DUN 221	161.666	73.954	5.229	10.098	B2.5Vn		-23.107	-23.107	16.144	-0.098
222	18 33 23.136	-38 43 33.60	18334-3844	DUN 222	358.485	21.247	5.598	6.260	B9V	B8	-20.368	-20.368	-0.145	-21.424
223			unidentified											
224	18 54 01.608	-47 16 27.84	18540-4716	DUN 224AC	62.269	86.649	6.987	7.289	F5V	A0IV/V	-38.288	-38.288	21.472	-22.312
225	19 12 24.120	-51 48 20.16	19124-5148	DUN 225AB	250.232	70.252	7.061	8.376	K5III	F6IV	-21.779	-21.779	0.381	-30.727
226	19 22 38.304	-44 27 32.40	19226-4428	DUN 226	76.029	28.332	3.953	7.111	B9V	A3	-11.929	-11.929	13.182	-14.984
227	19 52 37.728	-54 58 15.60	19526-5458	DUN 227	148.346	22.838	5.710	6.427	G8/K0III	A2V	3.509	3.509	19.910	2.370
228*			unidentified											
229*	19 58 15.288	-51 53 43.44	19583-5154	DUN 229	242.300	80.543	7.619	8.197	A9IV	F6V	-43.879	-43.879	45.758	-43.416
230	20 17 49.680	-40 11 05.28	20178-4011	DUN 230	116.871	9.558	7.342	7.622	F7/G0+F8/ G2		14.210	14.210	40.123	12.546
231*	20 36 35.952	-71 04 17.04	20366-7104	DUN 231	285.396	48.814	6.827	8.786	A0IV		-25.972	-25.972	91.473	-74.296
232*	20 41 44.112	-75 21 02.88	20417-7521	DUN 232	18.733	16.726	6.447	7.087	G1V	G5V	-162.079	-162.079	163.555	-171.231
233	20 35 34.848	-60 34 54.48	one				4.749		F1III		-184.963	-184.963		
234	20 37 34.032	-47 17 29.40	20376-4717	HJ 5209AB			3.104		K0III		67.590	67.590		
235*	20 44 57.576	-50 29 16.44	20450-5029	DUN 235AC	122.269	125.419	7.591	7.386	A0IV/V	K0III	-10.029	-10.029	28.227	-7.504
236*	21 02 12.744	-43 00 07.56	21022-4300	DUN 236	72.830	57.316	6.620	6.868	G3IV+...	K0IV	-121.947	-121.947	71.018	-111.224
237	21 32 00.744	-58 48 54.36	four				8.086		M3III:		-9.313	-9.313		
238	22 25 51.144	-75 00 56.52	22259-7501	DUN 238AB	78.395	21.475	6.111	8.718	G3IV	G0	12.925	12.925	30.613	-7.127
239	22 29 45.432	-43 44 57.12	22298-4345	DUN 239	210.661	60.684	4.151	9.684	M4.5IIIa		5.662	5.662	2.447	-6.740
240*	22 31 30.336	-32 20 45.96	22315-3221	PZ 7AC	172.462	30.140	4.283	7.123	A1V		-17.951	-17.951	56.838	-21.045
241*	22 36 35.448	-31 39 49.68	22366-3140	DUN 241	31.321	93.132	5.809	7.432	K2III	K2III	-40.126	-40.126	-8.840	-3.543
242*	22 39 44.184	-28 19 32.52	22397-2820	H 6 119AB	159.331	86.188	6.308	7.265	K0/K1III	F5V	-40.596	-40.596	96.340	-37.578
243	22 42 39.936 A	-46 53 04.56 A	three				2.114		M5III		135.16 A	-5.05 A		
244	23 02 16.032	-64 17 52.80	23023-6418	DUN 244	91.330	46.539	7.638	9.800	F3:IV/V+...		-48.390	-48.390	22.600	-7.841
245	23 08 37.608	-59 44 11.76	23086-5944	DUN 245	289.967	13.705	7.390	9.425	F5V		-63.923	-63.923	62.034	-67.227
246	23 07 14.784	-50 41 12.12	23072-5041	DUN 246	256.006	8.932	6.224	6.993	F6.5IV-V+..	F8/G2	-24.686	-24.686	-37.933	-30.367
247	23 18 00.792	-61 00 13.32	23180-6100	DUN 247	293.634	50.289	6.736	8.173	K1IIICN...	A6V	-90.261	-90.261	1.874	9.434
248	23 20 50.184	-50 18 23.76	23208-5018	DUN 248AB,C	211.911	16.964	6.054	8.723	FMDEL- TADEL	G4IV	-72.625	-72.625	42.769	-72.534
249*	23 23 54.528	-53 48 31.32	23239-5349	DUN 249	211.741	26.669	6.118	7.061	A4III	A3III	-34.465	-34.465	70.508	-27.565
250*	23 27 11.064	-50 16 46.92	23272-5017	DUN 250	82.691	28.297	7.491	8.385	K2III	K2/3	-35.168	-35.168	-14.629	-5.741
251*	23 39 27.936	-46 38 16.08	23395-4638	DUN 251	275.546	3.725	6.291	7.236	A8V+...		41.522	41.522	24.905	35.030
252*	23 44 12.048	-64 24 16.20	two	DUN 252AB	8.643	235.960	5.717	7.070	K3II	K1/K2III	34.864	34.864	31.237	-2.115
253*	23 54 21.408	-27 02 34.44	23544-2703	LAL 192	270.000	6.413	6.664	7.380	A2V+...	F2V	0.277	0.277	29.719	3.667