Totale Sternbedeckungen durch den Mond 1999

für Freiburg

Occultation Predictions for Freiburg calculated with OCCULT 4.06

E.Long. + 7 54 00 Lat. +48 00 00 Alt. 280 m. T.dia 200 mm. dMag 0

1999 January

Day	Time h m s	P	Star No	Sp D	Mag	% ill	Elon	Sun Alt	Moon Alt	Moon Az	CA o	PA o	WA o	Long Lib	Lat Lib	A m/o	B m/o
1	3 11 24	D	871	G8	6.7	98+	165		27	268	66N	46	47	+2.2	+6.2	+0.8	+0.0
3	3 58 05	R	97260a	K0	6.7	99-	166		38	254	41N	342	330	+5.0	+3.7	-0.1	-3.8
	Distance of 97260 to Terminator = 11.8 ; to 3km sunlit peak = 3.9																
	97260 = 7.9 & 9.6, Sepn 6.3, PA 273																
3	4 28 50	R	97268	K0	6.9	99-	166		33	260	75N	307	296	+4.9	+3.7	+0.3	-2.2
4	1 00 30	r	98033	F0	7.8	95-	155		58	173	86S	285	268	+6.1	+2.2	+1.6	-0.4
4	2 07 51	r	1306	A0	7.8	95-	154		57	202	79N	300	284	+6.0	+2.2	+1.4	-1.4
4	6 17 37	r	1324	G5	7.4	94-	152	-10	23	269	43N	337	320	+5.7	+2.1	-0.2	-2.8
5	2 41 29	R	1425x	F7	7.0	89-	141		55	193	54S	254	233	+6.4	+0.6	+2.0	+0.4
	1425 = 7.7 & 7.7, Sepn 0.006, PA 90																
5	22 08 30	r	1522	K0	6.8	83-	131		21	97	87S	288	266	+7.0	-0.9	+0.5	+0.9
5	23 14 57	r	99120	K0	7.2	82-	130		31	110	79N	302	279	+6.9	-0.9	+0.9	+0.3
6	1 02 07	r	99153m	F8	7.6	82-	130		45	138	75S	276	253	+6.7	-1.0	+1.5	+0.7
	99153 = 7.8 & 9.7, Sepn 0.580, PA 93																
6	2 25 08	r	99166	K2	8.3	82-	129		51	167	83N	298	276	+6.4	-1.0	+1.5	-0.7
7	1 22 18	D	1644	B9	4.1	73-	118		38	132	-69S	133	109	+6.2	-2.4	+1.1	-0.5
7	2 37 20	R	1644	B9	4.1	73-	117		46	156	73S	275	251	+6.0	-2.4	+1.8	+0.4
7	5 20 31	R	1656	K2	7.4	72-	116		43	213	64N	318	294	+5.6	-2.4	+1.1	-2.0
8	0 10 55	r	119212	K0	7.5	64-	107		19	109	28S	231	206	+5.7	-3.7	+1.0	+4.3
8	3 23 21	R	1749	K3	6.0	64-	106		42	158	88S	291	266	+5.2	-3.7	+1.6	-0.1
9	6 36 03	r	139097	G5	8.3	53-	93	-7	37	205	33N	349	326	+3.6	-4.6	+0.5	-2.9
11	4 28 19	R	2072	K0	6.6	35-	72		26	145	88S	288	269	+1.7	-5.9	+1.3	+0.5
12	4 56 11	r	159140	A7	8.0	26-	61		21	142	35N	343	328	+0.4	-6.1	+0.3	-1.4
19	16 15 55	d	3177k	A9	5.9	4+	24	-2	16	225	69N	51	72	-5.5	+0.7	+0.7	-0.2
	3177 = 6.8 & 6.8, Sepn 0.100, PA 90																
19	17 32 42	d	X50812	K2	9.4	4+	24		6	241	90N	72	93	-5.6	+0.7	+0.5	-0.9
21	17 08 05	d	146753	A0	9.1	17+	49	-10	28	218	64S	96	120	-4.8	+3.8	+1.5	-1.2
21	17 22 11	D	3463	K0	6.4	18+	50	-12	27	222	30N	10	35	-4.8	+3.8	+0.2	+2.0
21	17 24 19	d	X53532		9.6	18+	50		27	222	81N	60	85	-4.8	+3.8	+1.0	-0.2
21	18 08 05	D	146771	F8	8.1	18+	50		22	232	69S	90	115	-4.9	+3.8	+1.1	-1.3
21	18 11 52	d	146759	K2	8.8	18+	50		21	233	42N	21	46	-4.9	+3.8	+0.3	+1.1
22	17 41 51	d	128752	K5	9.0	27+	63		34	216	86S	73	98	-4.1	+5.2	+1.3	-0.4
22	19 18 20	d	128773	K2	8.6	28+	63		23	239	49S	110	134	-4.2	+5.2	+1.2	-2.3
22	20 35 21	D	62	F0	7.5	28+	64		12	255	56N	35	60	-4.3	+5.2	+0.3	+0.3
23	16 37 04	d	188	F0	7.6	37+	75	-4	45	181	75N	54	77	-3.0	+6.3	+1.3	+1.0
23	18 55 44	D	109805	K0	7.5	38+	76		36	225	23N	2	25	-3.3	+6.2	+0.2	+3.5
23	21 28 42	d	109873	A0	7.4	39+	77		15	258	37S	122	145	-3.4	+6.3	+0.5	-3.0
23	22 24 47	d	210a	B9	6.6	39+	78		6	269	41S	118	141	-3.4	+6.3	+0.1	-2.5
	210 = 6.6 & 8.6, Sepn 6.0, PA 328																
23	22 34 42	d	109899	K2	7.6	39+	78		4	271	86N	65	88	-3.4	+6.3	+0.1	-0.7
24	20 14 46	d	110446	A0	8.5	50+	90		37	235	51S	110	130	-2.3	+7.0	+1.3	-2.1
24	21 28 24	D	110464	K0	6.8	50+	90		26	252	61N	41	61	-2.4	+7.0	+0.7	+0.3
25	17 14 17	D	453x	M1	7.1	60+	102	-10	51	155	10N	353	10	-0.7	+7.4	-1.0	+6.7
	453 = 8.1 & 8.1, Sepn 0.100, PA 54																
25	19 14 57	D	462k	B8	6.0	61+	103		52	202	72N	55	71	-0.9	+7.3	+1.4	+0.8
	462 = 6.7 & 6.7, Sepn 0.100, PA 90																
26	17 02 58	d	93746	G5	8.0	71+	115	-8	48	130	54N	40	51	+0.7	+7.3	+0.8	+2.3
26	18 45 17	d	93774	F5	8.6	72+	116		57	168	62S	105	116	+0.5	+7.2	+1.9	-0.4
26	18 50 56	D	608m	F3	6.0	72+	116		57	170	84N	70	81	+0.5	+7.2	+1.5	+0.9
	608 = 6.0 & 8.8, Sepn 3.8, PA 221																
26	21 24 19	d	93806v	A0	7.7	73+	117		48	230	18N	4	15	+0.2	+7.1	+1.1	+6.3
	93806 = 8.6 & 9.4, Sepn 0.200, PA 226																
26	23 17 49	D	626	F5	6.3	73+	118		32	257	52S	115	125	+0.1	+7.1	+0.6	-2.2
27	1 04 08	D	635	G8	3.7	74+	119		15	277	74S	93	103	+0.0	+7.2	+0.1	-1.4
28	17 16 57	d	95190	G5	8.1	89+	142	-9	36	102	79S	95	94	+3.2	+5.9	+0.8	+1.2
28	18 45 50	d	95252m	F3	8.0	90+	143		49	124	79S	96	94	+3.1	+5.8	+1.3	+0.8

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       95252 =  8.0 &  9.7, Sepn 0.350, PA 167
28 18 56 46 d  95258 F8  7.7  90+ 143     51 127  78N  73  71 +3.1 +5.8 +1.2+1.5
       95258 =  8.1 & 10.5, Sepn 0.006, PA  51
28 20 49 39 d  95332 A0  8.3  90+ 144     60 171  34S 141 139 +2.9 +5.7 +1.9-2.7
28 21 59 34 D  95390 B8  7.4  90+ 144     59 203  80N  75  73 +2.8 +5.6 +1.6+0.2
28 22 37 42 D    943 B8  6.6  91+ 144     56 219  11S 164 162 +2.7 +5.6 +0.9-7.8
      Distance of    943 to Terminator =  9.1 ; to 3km sunlit peak =  1.6
28 23 07 24 D    947aF6  5.2  91+ 145     53 229  42N  38  35 +2.6 +5.6 +1.7+1.8
         947 =  5.2 & 11.2, Sepn 11.3, PA 202: & 10.5, Sepn 66.614, PA 277
28 23 38 10 d  95461 G5  7.7  91+ 145     49 238  69N  64  62 +2.6 +5.6 +1.4-0.1
28 23 47 40 D  95475aF5  7.3  91+ 145     47 241  78N  73  71 +2.6 +5.6 +1.3-0.5
       95475 =  7.3 & 11.6, Sepn  5.2, PA 138
29  0 05 17 d  95485 K0  7.3  91+ 145     45 245  82S  93  91 +2.5 +5.6 +1.1-1.2
29  0 25 27 d  95487 G5  8.0  91+ 145     42 250  24S 151 149 +2.5 +5.6 +0.3-4.0
29 17 11 42 d  96439 A2  7.3  95+ 155  -8 26  90  50S 128 121 +4.3 +4.7 +0.8+0.3
29 18 30 02 d  96493 K0  7.6  96+ 156     39 105  30N  28  20 +4.3 +4.6 +0.2+4.1
29 19 53 22 d  96575 A0  7.7  96+ 157     51 126  79S 100  92 +4.1 +4.5 +1.4+0.6
29 21 43 07 d  96635 A0  8.0  96+ 157     61 168  81N  80  72 +3.9 +4.4 +1.7+0.6
29 22 53 31 d  96687vA3  8.1  96+ 158     59 201  84S  94  86 +3.8 +4.4 +1.6-0.5
       96687 =  8.8 &  9.4, Sepn 0.045, PA  84
30 21 31 58 D  97646rG0  4.7  99+ 170     55 141  83N  81  68 +4.9 +2.9 +1.5+1.0
      Distance of  97646 to Terminator = 13.3 ; to 3km sunlit peak =  4.9
       97646 =  5.6 &  6.0, Sepn 0.884: &  6.2, Sepn  7.960
30 21 32 02 D   1236oG0  6.0  99+ 170     55 141  83N  81  68 +4.9 +2.9 +1.5+1.0
      Distance of   1236 to Terminator = 13.3 ; to 3km sunlit peak =  4.9
        1236 =  6.2 &  9.0, Sepn 0.190
30 21 32 18 D X54015 G5  6.2  99+ 170     55 141  83N  81  68 +4.9 +2.9 +1.5+1.0
      Distance of X54015 to Terminator = 13.3 ; to 3km sunlit peak =  4.9
30 22 45 47 r  97646rG0  4.7  99+ 171     59 172 -62N 297 283 +4.7 +2.9 +1.6-0.9
      Distance of  97646 to Terminator =  9.6 ; to 3km sunlit peak =  0.0
       97646 =  5.6 &  6.0, Sepn 0.884: &  6.2, Sepn  7.960
30 22 46 50 D   1241aA0  6.5  99+ 171     59 172  58N  56  42 +4.7 +2.9 +1.9+1.8
      Distance of   1241 to Terminator =  8.8 ; to 3km sunlit peak =  2.4
        1241 =  6.4 & 12.3, Sepn  1.5, PA 324: &  9.1, Sepn 58.407, PA 298
30 23 35 39 d  97680 K0  7.7  99+ 171     59 194  68N  66  52 +4.6 +2.9 +1.9+0.8
      Distance of  97680 to Terminator =  9.9 ; to 3km sunlit peak =  2.9
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1999 February

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Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D        ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1  0 41 35 r   1371oG9  6.5 100- 175     56 199  71S 282 263 +5.0 +1.3 +1.6-0.8
      Distance of   1371 to Terminator =  2.7 ; to 3km sunlit peak =  0.0
        1371 =  7.2 &  7.2, Sepn 0.200, PA 210
 1  2 13 33 R   1375 K1  5.4 100- 175     47 231  68N 322 303 +4.8 +1.3 +0.8-2.4
      Distance of   1375 to Terminator =  3.3 ; to 3km sunlit peak =  0.1
 1 19 46 39 R   1466vB9  5.3  98- 165     20  94  86N 294 273 +5.9 -0.2 +0.5+0.7
        1466 =  6.0 &  6.0, Sepn 0.050
 1 21 45 07 r  98906 K0  7.8  98- 164     39 118  80N 300 278 +5.7 -0.3 +1.1+0.2
 1 22 51 00 r  98928 K5  7.9  98- 164     47 137  77N 303 281 +5.6 -0.3 +1.3-0.3
Graze of   1487 B7  nearby at Lat = +44.85 -0.37(E.Long   -7.90), CA = -2.7N
 2  0 59 42 Gr  1487 B7  1.4  98- 163     57 185
Closest distance to graze path is  310km at azimuth 208
 3  4 10 29 d   1609cF2  4.6  93- 150     39 230 -79N  99  76 +4.7 -1.8 +1.3-1.4
        1609 =  4.7 & 11.0, Sepn  4.5, PA 271: &  9.0, Sepn 56.199, PA 309
 3  4 18 15 r 118636 K0  7.3  93- 150     38 233  49N 331 307 +4.7 -1.8 +0.6-2.5
 3  5 18 54 R   1609cF2  4.6  93- 149     29 247  71N 309 285 +4.6 -1.8 +0.6-2.1
        1609 =  4.7 & 11.0, Sepn  4.5, PA 271: &  9.0, Sepn 56.199, PA 309
 3  6 03 37 r 118658 F5  7.3  93- 149  -9 22 256  87N 294 270 +4.6 -1.9 +0.5-1.8
 4  6 00 23 r   1722 A0  7.7  87- 137  -9 26 243  44N 337 312 +4.1 -3.2 +0.4-2.7
 5  4 08 03 R 138889 A0  7.2  80- 126     40 200  64S 265 241 +3.6 -4.3 +2.0-0.4
 6  1 24 19 m 139299aF8  7.8  72- 116     29 138   7S 207 184 +3.2 -5.3 +9.9+9.9
      139299 =  8.2 & 13.8, Sepn  2.7, PA  89
Graze of 139299aF8  nearby at Lat = +48.88 -0.37(E.Long   -7.90), CA =  6.4S
 6  1 24 28 Gr139299aF8  7.8  72- 116     28 139
Closest distance to graze path is   85km at azimuth  29
 6  3 03 03 r 139316 K0  7.7  71- 115     37 166  66N 314 292 +2.9 -5.2 +1.3-0.9
 6  3 35 53 r 139325 K2  7.6  71- 115     37 176  43S 243 220 +2.8 -5.2 +2.8+1.5
 7  5 15 54 r 139792 K0  8.2  62- 104     33 192  43N 335 315 +1.4 -5.7 +1.0-2.0
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 8  1 45 42 R   2128 G7  5.8  53-  94     15 128  59S 255 239 +0.8 -6.2 +1.3+2.1
 9  2 58 21 R   2245 K0  6.3  44-  83     16 135  78S 271 259 -0.6 -6.2 +1.2+1.3
 9  4 02 38 r X39928 F5  8.3  43-  82     22 150  82S 275 263 -0.8 -6.1 +1.6+0.8
 9  5 26 57 r 159490 F0  8.3  43-  82     26 171  69N 304 292 -1.0 -6.0 +1.5-0.5
11  4 55 53 r 160539hG0  8.7  25-  60     14 142  75N 291 289 -3.1 -5.2 +1.1+0.7
      160539 =  9.5 &  9.5, Sepn 0.200, PA 168: & 12.9, Sepn  0.170, PA 187
13  5 22 58 r X45601 K0  8.8  10-  37      5 128  66S 242 250 -4.6 -3.1 +1.1+2.0
17 18 11 55 D   3421 M3  4.9   3+  18      2 257  68S  97 122 -4.9 +3.4 +0.3-1.7
        3421 = Khi AQR,  4.90 to  5.06V, Var Type LB
18 18 35 38 D 128631aF8  7.6   7+  32      9 255  61S 102 126 -3.9 +4.8 +0.5-1.9
      128631 =  7.8 &  9.4, Sepn  7.8, PA 292
19 17 45 58 d X 1447 K0  9.1  14+  45  -9 28 237  55S 108 131 -2.7 +6.0 +1.2-2.1
Graze of X32772 F0  nearby at Lat = +48.69 +0.18(E.Long   -7.90), CA =  5.5S
19 17 56 12 GrX32772 F0  9.1  14+  45 -11 26 239
Closest distance to graze path is   73km at azimuth 345
Graze of    150aF1  nearby at Lat = +48.73 +0.18(E.Long   -7.90), CA =  5.5S
19 17 56 42 Gr   150aF1  6.1  14+  45 -11 26 239
Closest distance to graze path is   79km at azimuth 345
19 17 57 04 M    150aF1  6.1  14+  45 -11 26 239   6S 157 180 -2.7 +6.0 +9.9+9.9
         150 =  6.2 &  8.6, Sepn 16.0, PA 253
19 18 09 59 d 109655 F2  9.0  15+  45     25 242  55S 107 131 -2.7 +6.0 +1.0-2.1
19 18 51 15 d 109670 G   9.5  15+  45     19 251  51S 111 134 -2.8 +6.0 +0.7-2.3
19 18 56 53 d 109673 K0  8.8  15+  45     18 252  79N  61  85 -2.8 +6.0 +0.5-0.5
19 19 45 56 D    165 K0  6.4  15+  46     10 261  75S  87 110 -2.8 +6.0 +0.3-1.3
20 17 59 16 d 110255 F8  8.7  24+  58 -11 37 231  78N  62  83 -1.4 +6.8 +1.1-0.1
20 18 10 57 d 110260 G0  8.8  24+  58     36 234  81N  64  85 -1.4 +6.8 +1.1-0.3
20 18 27 04 d 110253 F3  8.4  24+  58     34 238  17N   0  21 -1.5 +6.8 +0.3+4.4
20 18 44 15 d 110267 K   8.9  24+  59     31 242  59N  42  63 -1.5 +6.8 +0.8+0.4
20 18 47 52 d 110265dF5  9.1  24+  59     31 243  50N  33  54 -1.5 +6.8 +0.8+0.8
      110265 =  9.1 &  9.3, Sepn 45.5, PA 117
20 18 48 04 d 110269 G   9.0  24+  59     31 243  52N  35  56 -1.5 +6.8 +0.8+0.7
      110269 =  9.7 &  9.9, Sepn 45.3, PA 117
20 19 38 05 d 110288 G   8.8  24+  59     23 253  60N  44  65 -1.5 +6.8 +0.6+0.1
20 21 23 01 D    306 F0  6.8  25+  60      7 273  78N  61  82 -1.5 +6.9 +0.1-0.6
Graze of  93186 F0  nearby at Lat = +48.40 +0.12(E.Long   -7.90), CA =  3.9S
21 18 40 49 Gr 93186 F0  7.8  34+  72     42 230
Closest distance to graze path is   44km at azimuth 350
21 18 40 57 m  93186 F0  7.8  34+  72     42 231   4S 161 178 -0.1 +7.2 +9.9+9.9
21 19 15 06 d  93198 K0  8.7  35+  72     38 239  39S 126 143 -0.2 +7.2 +1.3-3.2
21 21 16 12 D    444 K6  5.9  35+  73     19 265  25S 140 157 -0.3 +7.3 +0.1-4.4
22 17 32 09 d  93633 K0  8.6  45+  85  -6 56 190  17S 152 164 +1.3 +7.3 +9.9+9.9
Graze of  93633 K0  nearby at Lat = +47.66 +0.22(E.Long   -7.90), CA =  5.7S
22 17 39 36 Gr 93633 K0  8.6  46+  85  -7 56 193
Closest distance to graze path is   36km at azimuth 162
22 18 35 15 D    576aG5  7.9  46+  85     52 214  89N  77  89 +1.2 +7.2 +1.5-0.2
         576 =  8.1 & 11.6, Sepn  8.6, PA 103
23 18 19 49 D    729 F8  7.1  57+  98     59 187  49N  41  48 +2.4 +6.8 +1.4+1.9
23 20 14 54 D  94187vF8  7.2  58+  99     50 231  58S 115 121 +2.2 +6.8 +1.3-2.0
       94187 =  7.9 &  7.9, Sepn 0.050
23 21 56 38 D    741xK1  5.5  59+ 100     35 256  67S 106 112 +2.0 +6.8 +0.7-1.8
         741 =  6.5 &  6.5, Sepn 0.080, PA 240
24 18 02 55 d  94883 F0  7.8  68+ 111 -11 58 153  89N  86  86 +3.5 +6.1 +1.6+0.6
24 18 35 50 d  94900 A2  8.7  68+ 112     60 167  72S 105 105 +3.4 +6.0 +1.7-0.4
24 19 02 15 D    886kK0  6.8  69+ 112     61 180  66S 111 111 +3.4 +6.0 +1.8-0.9
         886 =  7.7 &  7.7, Sepn 0.030, PA  63
24 19 29 26 D  94927 G5  7.0  69+ 112     60 193  33S 144 144 +3.3 +6.0 +1.8-3.7
24 21 04 31 d X 7838 A0  8.0  69+ 113     52 230  44N  42  42 +3.1 +6.0 +1.6+1.3
      X 7838 =  8.5 &  8.5, Sepn  3.1, PA 148
24 21 16 10 d  94978kG5  8.3  69+ 113     50 234  34S 144 144 +3.1 +6.0 +1.0-3.7
       94978 =  8.7 &  9.6, Sepn 0.020, PA 217
24 23 16 09 D    904 K0  7.1  70+ 114     33 262  64N  62  61 +2.9 +6.0 +0.9-0.5
24 23 36 18 d  95090 A0  7.6  70+ 114     29 266  54N  52  52 +2.9 +6.0 +0.9-0.2
25 18 40 43 d  96153xA0  8.2  78+ 125     57 145  60N  62  56 +4.3 +4.9 +1.5+1.7
       96153 =  8.4 &  8.4, Sepn 0.100, PA 302
25 19 19 57 d  96172vF5  8.0  79+ 125     60 162  26S 156 150 +4.2 +4.9 +1.9-4.6
       96172 =  8.9 &  8.9, Sepn 0.050
25 19 34 47 d  96180 A0  8.3  79+ 125     61 169  16N  19  13 +4.2 +4.9 +1.6+7.0
25 22 28 40 d  96283 B9  8.1  79+ 126     49 238  54S 128 122 +3.8 +4.8 +0.9-2.4
26  0 46 27 d  96378kK5  8.1  80+ 127     27 268  76N  79  72 +3.6 +4.8 +0.6-1.1
       96378 =  8.9 &  8.9, Sepn 0.200, PA 100
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26  2 08 20 d  96439 A2  7.3  81+ 128     14 282  80S 103  96 +3.6 +4.8 -0.1-1.5
26 17 37 53 d  97220 A2  8.2  87+ 137  -6 41 110  71S 116 105 +5.0 +3.6 +1.2+0.4
26 17 53 03 D   1175vK5  4.9  87+ 137  -8 44 114  23N  30  19 +5.0 +3.6 +0.6+4.6
       1175 =  5.8 &  5.8, Sepn 0.100, PA  90
26 18 26 45 r   1175vK5  4.9  87+ 137     49 123 -32N 335 324 +4.9 +3.5 +1.7-2.9
       1175 =  5.8 &  5.8, Sepn 0.100, PA  90
26 18 50 20 D  97260aK0  6.7  87+ 138     51 129  66N  73  61 +4.9 +3.5 +1.4+1.6
       97260 =  7.9 &  9.6, Sepn  6.3, PA 273
26 19 07 11 D  97268 K0  6.9  87+ 138     53 135  84S 103  91 +4.9 +3.5 +1.5+0.3
26 22 36 10 D   1192 K4  7.3  88+ 139     54 223  70N  78  66 +4.4 +3.4 +1.6-0.3
26 22 40 47 d  97360 G6  7.9  88+ 139     53 224  80S 108  96 +4.4 +3.4 +1.3-1.4
27 17 40 15 d   1306 A0  7.8  93+ 150  -6 32 101  81N  93  77 +5.4 +2.1 +0.7+1.3
27 22 31 24 d   1324 G5  7.4  94+ 152     57 198  87S 106  89 +4.8 +1.9 +1.6-0.9
27 23 38 26 d X13499 K0  8.3  94+ 152     51 224  75S 118 101 +4.6 +1.9 +1.2-1.7
28  1 21 37 d  98236 F8  8.0  94+ 153     37 251  74N  87  70 +4.5 +1.9 +1.0-1.2
28  2 09 07 D   1337 F0  5.7  95+ 153     29 261  81N  93  76 +4.4 +1.9 +0.6-1.5
28  2 20 26 D   1336 A5  5.2  95+ 153     27 263  33S 160 142 +4.4 +1.9 -0.2-3.0
28 21 17 44 D  98730 K0  7.1  98+ 164     52 147  55N  73  53 +5.2 +0.3 +1.8+1.5
```

1999 March

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Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
Graze of   1644 B9  nearby at Lat = +44.92 -0.01(E.Long   -7.90), CA = 11.1S
 2 19 24 57 Gr  1644 B9  4.1 100- 173     18  99
Closest distance to graze path is  342km at azimuth 181
 2 19 46 20 R   1644 B9  4.1 100- 173     21 104  45S 233 209 +5.0 -2.6 +0.7+3.6
      Distance of   1644 to Terminator =  3.8 ; to 3km sunlit peak =  0.3
 2 22 27 12 r   1656 K2  7.4  99- 172     42 143  75S 265 241 +4.6 -2.7 +1.7+1.1
      Distance of   1656 to Terminator =  9.1 ; to 3km sunlit peak =  2.5
 3 20 07 44 r   1749 K3  6.0  97- 161     14 103  48S 243 219 +4.4 -3.9 +0.6+2.8
 4  2 18 42 r 119325 K0  7.6  97- 159     40 206  47N 329 305 +3.5 -3.9 +1.0-2.1
 5 23 04 15 r   1976 A3  7.0  87- 137     20 126  58S 254 233 +2.3 -5.6 +1.3+2.2
 5 23 38 00 R   1978vK0  6.6  87- 137     24 134  50S 246 225 +2.3 -5.6 +1.8+2.6
       1978 =  7.4 &  7.4, Sepn 0.100, PA  90
 6  2 15 46 r 139592 G5  7.7  86- 136     35 177  75S 271 250 +1.8 -5.5 +2.0+0.1
 7  4 11 48 m 158732 K2  7.7  78- 125     29 197   8S 203 185 +0.3 -5.9 +9.9+9.9
      Distance of 158732 to Terminator = 18.3 ; to 3km sunlit peak =  3.5
10  8 00 07 D X42057 M6  0.0  51-  91  19 15 216 -70S 115 111 -4.0 -5.2 +1.5-1.6
10  9 11 44 R X42057 M6  0.0  50-  90  29  7 231  67S 252 248 -4.2 -5.2 +0.8-1.1
11  2 24 45 r 160891 G8  7.2  42-  81      6 128  72N 289 290 -4.0 -4.7 +0.7+1.0
12  3 26 58 R   2729uB9  6.9  33-  70      7 131  71N 286 292 -5.1 -3.6 +0.8+1.0
       2729 =  7.1 &  7.9, Sepn 0.000
       2729 = V 356 SGR,  6.84 to  7.66V, Var Type EA/DS:, Phase .99
12  4 30 03 R   2734 K2  5.2  32-  69     14 144  74N 282 288 -5.2 -3.5 +1.2+0.9
12  5 16 57 R 187349vG0  6.8  32-  69  -6 18 154  63N 293 299 -5.4 -3.5 +1.4+0.4
      187349 =  8.3 &  8.3, Sepn 0.050
      187349 = BB SGR,  6.55 to  7.30V, Var Type DCEP, Phase .70
12  5 21 17 r 187358vB8  7.5  32-  69  -5 18 155  64N 292 298 -5.4 -3.5 +1.5+0.4
      187358 =  8.4 &  8.4, Sepn 0.050
13  5 03 40 d   2886 K0  4.9  23-  58  -8 12 139 -60S 111 123 -5.9 -2.2 +1.1+0.8
14  5 32 23 r   3017 M1  5.2  15-  45  -3 12 134  48S 214 231 -6.2 -0.7 +1.3+2.5
19 18 44 15 D 110072 F8  8.7   5+  27 -12 10 266  86N  75  97 -2.1 +6.5 +0.2-0.9
19 19 07 27 d X 2389 G0  9.2   5+  27      6 270  39S 130 152 -2.1 +6.5 -0.0-3.3
19 19 18 08 D X 2405 K0  8.3   6+  27      5 272  79S  89 111 -2.1 +6.5 +0.0-1.3
19 19 18 25 D 110085 G0  8.2   6+  27      5 272  74N  63  85 -2.1 +6.5 +0.1-0.6
19 19 27 49 d 110087 G0  8.8   6+  27      3 274  51N  40  62 -2.1 +6.5 +0.1+0.1
      110087 =  9.5 & 10.5, Sepn 0.200, PA  31
20 12 53 05 D    364 B9  4.3  11+  38  39 48 153  59S 110 129 +0.0 +7.2 +2.0-0.1
20 19 04 10 d 110662 G5  9.5  12+  41     19 263  52S 117 135 -0.4 +7.1 +0.4-2.4
20 19 45 36 d 110674 G0  9.0  12+  41     12 271  28S 141 159 -0.4 +7.1 -0.1-4.3
20 20 25 20 d 110698 G5  8.8  13+  42      6 278  76S  92 110 -0.3 +7.1 -0.0-1.4
21 15 37 51 D    508vK0  4.1  20+  53  19 54 194  41S 129 143 +1.5 +7.2 +2.3-2.7
        508 =  4.5 &  6.5, Sepn 0.011
Graze of    508vK0  nearby at Lat = +45.16 +0.22(E.Long   -7.90), CA =  9.1S
21 15 56 57 Gr   508vK0  4.1  20+  53  17 56 203
Closest distance to graze path is  302km at azimuth 163
21 16 17 43 r    508vK0  4.1  20+  53  13 52 210 -24S 194 208 +1.5 +7.2 +0.9+3.3
        508 =  4.5 &  6.5, Sepn 0.011
```

```
21 18 37 21 d  93511 K2  8.8  21+  54 -10 35 250  75N  65  79 +1.3 +7.2 +0.9-0.5
21 19 01 41 d  93514 A0  8.5  21+  54     31 255  14S 157 171 +1.3 +7.2 +9.9+9.9
Graze of  93514 A0  nearby at Lat = +47.69 -0.07(E.Long   -7.90), CA =  2.9S
21 19 08 12 Gr 93514 A0  8.5  21+  55     30 256
Closest distance to graze path is   34km at azimuth 186
21 19 33 20 d  93529 F8  8.9  21+  55     26 261  81S  89 103 +1.3 +7.2 +0.6-1.3
21 19 48 53 d  93530 F8  9.3  21+  55     24 264  88N  79  92 +1.3 +7.2 +0.5-1.1
21 19 54 26 D  93531 A0  8.3  21+  55     23 265  81N  72  85 +1.3 +7.2 +0.5-0.9
21 20 07 46 D    526 G5  6.7  21+  55     21 268  43N  34  47 +1.3 +7.2 +0.6+0.5
21 20 33 24 D  93548 G5  8.1  22+  55     17 272  46S 124 138 +1.3 +7.2 +0.0-2.6
21 20 38 20 d  93551 M0  8.8  22+  55     16 273  89S  81  95 +1.3 +7.2 +0.2-1.1
21 21 20 37 d X 4767 G0  9.0  22+  56      9 280  84S  87 100 +1.3 +7.2 -0.0-1.2
22 10 20 34 d    635 G8  3.7  28+  64  40 17  85  70N  63  72 +3.4 +7.3 -0.0+1.7
22 11 16 52 r    635 G8  3.7  29+  65  42 26  95 -89N 264 274 +3.4 +7.2 +0.4+1.5
22 14 43 40 d    667vK2  5.0  30+  66  28 55 148  48N  42  50 +3.3 +7.0 +1.1+2.2
         667 =  5.4 &  7.9, Sepn 0.024, PA 238
22 14 47 25 D    669vG7  3.8  30+  66  27 55 149  37S 137 145 +3.2 +7.0 +2.5-2.4
         669 =  4.0 &  7.8, Sepn 0.082, PA 212
Graze of    669vG7  nearby at Lat = +45.76 +0.30(E.Long   -7.90), CA =  9.8S
22 15 02 10 Gr   669vG7  3.8  30+  66  26 58 154
Closest distance to graze path is  228km at azimuth 157
22 15 21 50 r    669vG7  3.8  30+  67  22 57 164 -18S 191 200 +3.2 +7.0 +0.5+4.5
         669 =  4.0 &  7.8, Sepn 0.082, PA 212
22 15 44 32 D    677xA6  4.8  30+  67  19 58 173  66S 107 116 +3.1 +6.9 +1.8-0.6
         677 =  5.6 &  5.6, Sepn 0.020, PA 344
22 18 41 49 D    692 K5  0.9  31+  68 -11 45 239  76S  98 106 +2.8 +6.8 +1.2-1.4
         692 =  1.1 & 11.3, Sepn %132.4, PA  32: & 13.6, Sepn 30.800, PA 110
         692 = Alpha TAU,  0.75 +/- 0.95V, Var Type LB:
22 19 47 42 R    692 K5  0.9  32+  68     35 255 -72S 246 254 +2.8 +6.8 +0.9-0.6
         692 =  1.1 & 11.3, Sepn %132.4, PA  32: & 13.6, Sepn 30.800, PA 110
         692 = Alpha TAU,  0.75 +/- 0.95V, Var Type LB:
22 20 24 56 d  94056 K5  8.3  32+  69     29 262  75N  69  77 +2.7 +6.8 +0.7-0.7
22 20 43 23 d  94060mF5  8.8  32+  69     26 266  50S 124 131 +2.7 +6.8 +0.3-2.5
       94060 =  8.8 & 10.8, Sepn 0.800, PA 220
22 21 21 25 d  94069mA2  8.9  32+  69     20 273  84S  90  97 +2.7 +6.9 +0.3-1.4
       94069 =  9.7 &  9.7, Sepn 0.200, PA  44
23 14 12 04 d    814tB5  5.4  41+  80  32 46 118  35S 142 145 +4.6 +6.3 +2.2-1.8
         814 =  5.7 &  6.6, Sepn 0.108, PA  98: & 10.1, Sepn 10.100, PA 306
23 16 56 26 D    832 M2  4.3  42+  81   7 61 179  44N  42  45 +4.3 +6.2 +1.5+2.1
         832 = CE TAU,  4.23 to  4.54V, Var Type SRC
23 17 32 11 D    836 B2  5.7  42+  81   1 60 196  67N  65  67 +4.3 +6.1 +1.6+0.7
23 17 55 17 R    832 M2  4.3  42+  81  -3 58 207 -54N 304 306 +4.2 +6.1 +1.6-2.0
         832 = CE TAU,  4.23 to  4.54V, Var Type SRC
23 18 25 42 d  94663mA0  8.6  42+  81  -8 56 218  54N  52  54 +4.1 +6.1 +1.6+0.9
       94663 =  9.4 &  9.4, Sepn 0.500, PA 126
23 18 44 15 r    836 B2  5.7  42+  81 -11 54 225 -74N 284 286 +4.1 +6.1 +1.4-1.3
23 18 57 33 d  94686 K0  8.7  43+  81     52 229  71N  70  71 +4.1 +6.1 +1.5-0.1
23 19 17 18 D  94678kK5  7.6  43+  82     50 236   6N   4   6 +4.0 +6.1 +9.9+9.9
       94678 =  7.7 &  8.7, Sepn 0.800, PA  96
Graze of  94678kK5  nearby at Lat = +48.14 -0.12(E.Long   -7.90), CA = -1.1N
23 19 21 36 Gr 94678kK5  7.6  43+  82     49 237
Closest distance to graze path is   15km at azimuth  10
23 22 08 21 d  94784 F2  8.1  44+  83     23 272  50N  48  49 +3.9 +6.1 +0.7-0.2
23 23 21 03 d    871 G8  6.7  44+  83     12 285  41N  40  41 +3.9 +6.1 +0.4-0.0
24 18 44 22 D   1006vA0  7.1  54+  94 -10 60 203  19N  22  17 +5.1 +5.0 +2.0+5.4
        1006 =  7.7 &  7.7, Sepn 0.050
24 19 01 09 D  95873 K0  7.7  54+  94     58 210  53S 130 126 +5.0 +5.0 +1.4-2.3
24 19 40 32 D  95902 K0  7.6  54+  95     54 225  88N  91  86 +5.0 +5.0 +1.5-0.8
24 20 46 45 d  95939 M2  8.5  55+  95     46 244  61N  64  60 +4.8 +5.0 +1.4-0.2
24 21 26 20 d  95965 K0  8.1  55+  95     40 254  36N  39  34 +4.8 +5.0 +1.6+1.0
25  0 11 46 d   1038vB9  7.1  56+  97     13 284  69S 115 110 +4.7 +5.0 -0.2-1.7
        1038 =  7.6 &  7.6, Sepn 0.050
25 23 01 44 d  97144 K5  8.4  66+ 109     33 261  68S 120 110 +5.2 +3.7 +0.4-2.1
26 21 08 35 d  97919vG5  8.4  75+ 121     55 215  71N  85  69 +5.7 +2.2 +1.7-0.5
       97919 =  9.0 &  9.1, Sepn 0.057, PA  39
27  0 46 33 d  98033 F0  7.8  77+ 122     23 269  53N  67  51 +5.3 +2.2 +0.6-0.9
27 20 04 05 d  98571aA3  7.8  84+ 133     56 166  51N  69  49 +5.9 +0.7 +2.0+1.3
       98571 =  7.9 & 13.9, Sepn 12.8, PA 153
27 20 08 55 D   1396 K2  6.8  84+ 133     56 168  88S 109  90 +5.9 +0.7 +1.6-0.5
28 22 16 12 d   1515 F8  7.9  91+ 145     51 200  90N 112  89 +5.3 -0.8 +1.5-1.1
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28 23 52 29 D   1522 K0  6.8  91+ 146     42 231  56N  78  55 +5.1 -0.8 +1.6-0.8
29 18 24 18 D   1609cF2  4.6  96+ 156  -6 28 112  32S 175 151 +5.5 -2.2 +0.6-3.5
       1609 =  4.7 & 11.0, Sepn  4.5, PA 271: &  9.0, Sepn 56.177, PA 309
29 18 55 29 r   1609cF2  4.6  96+ 156 -11 33 119 -19S 226 202 +5.5 -2.2 +1.5+5.0
      Distance of   1609 to Terminator = 10.1 ; to 3km sunlit peak =  0.0
       1609 =  4.7 & 11.0, Sepn  4.5, PA 271: &  9.0, Sepn 56.177, PA 309
30  4 18 15 d   1644 B9  4.1  97+ 159 -10  5 274  36N  63  39 +4.3 -2.2 +0.1-1.0
31  2 16 53 d 119212 K0  7.5  99+ 170     28 239  56N  93  69 +3.7 -3.4 +1.1-1.5
      Distance of 119212 to Terminator = 10.1 ; to 3km sunlit peak =  3.0
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1999 April

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Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 2 21 37 31 r   2043kK0  6.5  96- 157     18 126  32N 336 317 +1.8 -5.8 +0.3-1.0
       2043 =  7.4 &  7.4, Sepn 0.100, PA  90
 2 22 10 57 r   2047 K0  6.6  96- 157     22 134  51N 318 299 +1.7 -5.8 +0.7-0.2
 4  0 06 58 r   2158 A0  7.5  91- 145     25 153  83N 287 271 +0.3 -5.9 +1.5+0.4
 5  2 06 20 R   2280 M1  6.5  85- 134     26 173  68N 299 288 -1.3 -5.7 +1.6-0.4
 5  4 24 50 R   2291vF7  5.5  84- 133  -7 21 208  45S 233 222 -1.8 -5.7 +1.8+0.0
       2291 =  6.3 &  6.3, Sepn 0.050
 8  0 59 21 R   2666mA1  4.8  60- 102      4 127  80S 257 261 -4.8 -3.9 +1.0+1.8
       2666 =  5.1 &  7.6, Sepn  1.8, PA 286
10  3 12 43 r   2949 K5  7.6  40-  78     10 133  53S 220 234 -6.8 -1.2 +1.4+2.4
11  3 27 29 r 164161 A5  8.1  30-  66      7 125  63N 280 299 -7.2 +0.3 +0.7+1.2
11  4 03 57 r   3091 K4  6.7  30-  66  -8 12 132  47N 295 314 -7.2 +0.3 +0.9+0.8
18 19 17 59 d X 5527 K0  8.6  10+  37  -9 18 273  78N  76  85 +1.9 +6.9 +0.3-1.0
18 21 01 24 D    635 G8  3.7  10+  38      2 291  24S 154 163 +2.0 +6.9 -1.1-4.0
19 19 49 55 d  94452 A0  9.0  18+  51     25 270  76N  76  80 +3.6 +6.2 +0.5-1.0
19 19 51 41 d  94450cK0  9.0  18+  51     24 271  54S 126 129 +3.7 +6.2 +0.1-2.4
       94450 =  9.0 & 10.5, Sepn  6.5, PA 353
19 20 22 31 D  94462 F5  8.1  19+  51     19 276  81N  81  85 +3.7 +6.2 +0.2-1.1
19 20 37 15 d  94470 A0  9.0  19+  51     17 279  51S 129 132 +3.7 +6.2 -0.2-2.3
20 17 17 46 d    947aF6  5.2  27+  63  10 56 220  66S 117 115 +5.3 +5.2 +1.4-1.7
        947 =  5.2 & 11.2, Sepn 11.2, PA 202: & 10.5, Sepn 66.583, PA 277
20 18 23 18 r    947aF6  5.2  28+  64  -1 48 241 -61S 245 242 +5.2 +5.2 +1.4-0.2
        947 =  5.2 & 11.2, Sepn 11.2, PA 202: & 10.5, Sepn 66.583, PA 277
20 18 30 39 d  95475aF5  7.3  28+  64  -2 47 242  23S 160 158 +5.2 +5.2 +0.3-5.7
       95475 =  7.3 & 11.6, Sepn  5.2, PA 138
20 18 57 33 D  95495 A0  7.5  28+  64  -6 43 249  41N  44  42 +5.1 +5.2 +1.4+0.7
20 19 16 12 d  95511 A0  8.7  28+  64  -9 40 253  68N  71  69 +5.1 +5.2 +1.1-0.7
20 21 00 18 d  95592 F8  8.4  29+  65     24 273  46N  50  47 +5.1 +5.2 +0.7-0.3
21 21 52 36 d  96864 K5  8.0  40+  78     24 272  70N  79  70 +6.0 +3.9 +0.4-1.2
21 22 20 28 d  96872 K0  7.5  40+  79     20 277  36N  45  36 +6.0 +3.9 +0.7-0.2
21 23 00 11 d  96897gF0  7.3  40+  79     13 283  36S 153 144 +6.0 +3.9 -0.6-2.7
       96897 =  7.7 &  8.7, Sepn 60.8, PA  97: & 10.7, Sepn 19.900, PA 320
22 16 48 23 D  97646rG0  4.7  49+  89  15 58 157  27S 166 152 +7.1 +2.5 +1.3-5.0
       97646 =  5.6 &  6.0, Sepn 0.884: &  6.2, Sepn  7.960
22 17 21 26 r  97646rG0  4.7  49+  89  10 59 172 -21S 214 200 +7.0 +2.5 +2.3+4.7
       97646 =  5.6 &  6.0, Sepn 0.884: &  6.2, Sepn  7.960
22 18 35 52 d  97680 K0  7.7  50+  90  -2 58 204  56S 137 123 +6.8 +2.5 +1.2-2.3
22 21 52 35 D X12632aF8  7.5  51+  91     32 260  77S 116 101 +6.5 +2.4 +0.5-1.9
      X12632 =  6.8 &  6.8, Sepn  9.6, PA 270
      X12632 = V CNC,  7.50 to 13.90V, Var Type M, Phase .48
22 22 09 22 d  97757vA3  8.2  51+  91     29 264  15N  28  14 +6.5 +2.4 +2.6+2.9
       97757 =  9.0 &  9.0, Sepn 0.050
Graze of  97757vA3  nearby at Lat = +48.80 -0.47(E.Long   -7.90), CA =  1.5N
22 22 15 18 Gr 97757vA3  8.2  51+  91     28 265
Closest distance to graze path is   73km at azimuth  36
22 23 14 00 D   1260 F5  7.1  51+  92     19 275  86N 100  85 +6.5 +2.4 +0.1-1.6
22 23 44 52 D   1262 F6  6.1  52+  92     14 280  79S 115 100 +6.5 +2.4 -0.1-1.7
       1262 =  8.0 &  8.0, Sepn 0.100, PA  90
23 19 55 16 D   1371oG9  6.5  61+ 103     53 214  11S 186 168 +6.9 +0.9 -1.5-9.1
       1371 =  7.2 &  7.2, Sepn 0.200, PA 210
Graze of   1371oG9  nearby at Lat = +47.45 -0.39(E.Long   -7.90), CA = -2.1S
23 20 04 36 Gr  1371oG9  6.5  61+ 103     53 218
Closest distance to graze path is   53km at azimuth 210
23 21 06 27 D   1375 K1  5.4  61+ 103     45 236  72S 125 107 +6.7 +0.9 +0.9-2.0
23 21 23 05 d  98461 F0  7.8  61+ 103     43 240  83N 100  81 +6.7 +0.9 +1.1-1.4
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23 21 32 40 d  98463 F5  8.6  61+ 103     41 243  74S 124 105 +6.7 +0.9 +0.8-2.0
23 22 14 07 r   1375 K1  5.4  62+ 104     35 253 -76S 274 255 +6.6 +0.9 +0.9-1.4
24 15 24 16 d   1466vB9  5.3  70+ 113  30 30 106  39S 162 140 +7.4 -0.5 +0.9-2.1
        1466 =  6.0 &  6.0, Sepn 0.050
24 18 37 07 d  98928 K5  7.9  71+ 114  -2 53 161  67S 133 112 +7.0 -0.6 +1.4-1.3
24 21 32 25 d  98966 G   7.6  71+ 115     46 227  38N  59  37 +6.5 -0.6 +2.2+0.3
24 21 37 06 D   1487 B7  1.4  71+ 115     45 228  43N  63  41 +6.5 -0.6 +2.0-0.0
        1487 =  1.3 &  7.6, Sepn %177.8, PA 307
24 22 24 16 R   1487 B7  1.4  72+ 116     38 241 -38N 343 321 +6.4 -0.6 +0.2-3.2
        1487 =  1.3 &  7.6, Sepn %177.8, PA 307
26  1 03 37 d 118636 K0  7.3  81+ 128     18 261  57N  80  56 +5.6 -2.0 +0.5-1.4
26  1 47 21 D   1609cF2  4.6  81+ 129     11 269  82N 106  82 +5.6 -2.0 +0.1-1.7
        1609 =  4.7 & 11.0, Sepn  4.5, PA 271: &  9.0, Sepn 56.154, PA 309
26 18 40 40 d 119000 G0  7.3  87+ 138  -2 38 136  35N  61  36 +5.9 -3.3 +2.0+3.0
28  1 59 05 d 138889 A0  7.2  94+ 152     17 249  74N 103  79 +3.9 -4.2 +0.6-1.7
29  0 11 54 d 139299aF8  7.8  98+ 162     32 212  66N  99  76 +3.2 -5.0 +1.6-1.1
      139299 =  8.2 & 13.8, Sepn  2.7, PA  89
29  1 08 45 D   1921 K3  5.9  98+ 162     26 227  87S 126 104 +3.0 -5.0 +1.1-1.9
29  2 12 12 D   1924 F3  5.8  98+ 163     18 241  62S 152 129 +2.8 -5.0 +0.7-2.5
```

1999 May

```
Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1 20 57 44 R   2223tK0  3.9  98- 165     12 129  67N 290 277 +0.4 -5.9 +0.8+0.8
        2223 =  4.7 &  4.9, Sepn 0.100, PA 197: & 11.2, Sepn 41.700, PA 153
 2  3 04 21 R   2247 A6  5.4  98- 163 -10 18 218  81S 260 248 -0.8 -5.6 +1.4-1.0
 2 23 04 57 r 159919 F5  7.2  95- 154     18 148  80S 261 253 -1.2 -5.4 +1.7+1.3
 3  0 10 58 r 159935 A0  7.2  95- 153     23 163  57S 238 230 -1.4 -5.4 +2.4+1.7
 5  4 18 44 r   2638 B0  5.3  82- 130   1 19 201  82N 274 277 -4.7 -3.7 +1.7-0.8
 8  1 58 23 r   3038dK1  7.1  56-  97     11 133  47S 212 229 -7.1 -0.0 +1.4+2.6
        3038 =  6.7 &  7.7, Sepn 15.8, PA 294
 8  2 46 05 R   3041 K3  6.2  56-  97 -11 16 143  83S 247 264 -7.2 +0.0 +1.4+1.5
17  8 36 01 D    832 M2  4.3   6+  27  45 26  91  70N  77  79 +4.1 +6.0 +0.3+1.6
         832 = CE TAU,  4.23 to  4.54V, Var Type SRC
17  9 09 13 d    836 B2  5.7   6+  28  50 31  97  85S 101 103 +4.1 +5.9 +0.7+1.1
17  9 35 44 r    832 M2  4.3   6+  28  54 36 102 -73S 260 262 +4.1 +5.9 +0.7+1.5
         832 = CE TAU,  4.23 to  4.54V, Var Type SRC
17 20 16 22 D  95031 B9  7.9   8+  33 -11  9 289  46N  52  52 +3.7 +5.5 +0.1-0.4
17 20 25 08 D  95049 A2  8.4   8+  33 -12  8 290  79S 108 107 +3.7 +5.5 -0.3-1.5
17 20 47 09 d X 7988 B8  8.9   8+  33       4 294  57S 129 129 +3.8 +5.5 -0.5-1.8
17 20 50 45 d  95071 G0  8.5   8+  33       4 294  84S 102 101 +3.8 +5.5 -0.4-1.3
17 20 58 34 d    904 K0  7.1   8+  33       2 296  45S 141 141 +3.8 +5.5 -0.7-2.1
18 19 49 01 d   1060kK2  7.3  15+  46  -7 23 274  66S 123 116 +5.3 +4.2 +0.0-2.0
        1060 =  8.2 &  8.2, Sepn 0.030, PA  30
18 20 49 00 D  96382 K0  7.9  16+  47     13 284  81S 108 101 +5.3 +4.2 -0.1-1.6
18 21 16 16 d  96404 A0  8.9  16+  47      9 288  88N  97  90 +5.3 +4.2 -0.2-1.3
18 21 18 30 d X10314 A2  8.7  16+  47      9 289  73N  82  75 +5.3 +4.2 -0.1-1.1
18 21 19 17 d  96396kK2  8.9  16+  47      9 289  34N  43  36 +5.3 +4.2 +0.3-0.2
       96396 =  9.5 &  9.5, Sepn 0.100, PA  90
18 21 40 48 D   1076 A0  7.5  16+  47      6 293  83N  92  85 +5.4 +4.2 -0.3-1.2
19 20 26 45 D   1203vG5  7.1  25+  60 -11 26 269  88N 101  88 +6.4 +2.8 +0.3-1.6
        1203 =  7.9 &  7.9, Sepn 0.050, PA  90
19 20 45 32 d  97480 F0  8.9  25+  60     23 273  48N  61  48 +6.4 +2.8 +0.6-0.7
20 19 59 21 d  98248 G0  8.1  35+  73  -8 37 251  58N  75  57 +7.1 +1.2 +1.1-0.9
20 20 07 09 d  98249 K0  7.9  35+  73  -9 36 253  65N  81  64 +7.1 +1.2 +1.0-1.1
21 14 56 52 d   1434 M2  5.4  44+  83  39 45 127  45N  65  44 +8.0 -0.3 +1.5+2.3
21 19 44 44 D   1449 M0  6.5  46+  85  -6 44 232  66S 133 112 +7.3 -0.4 +0.9-2.1
21 20 14 41 d X14875 K5  8.7  46+  85 -10 41 240  43N  63  42 +7.3 -0.4 +1.7-0.3
21 23 31 12 D   1466vB9  5.3  47+  87      9 279  75S 125 104 +7.1 -0.4 -0.2-1.8
        1466 =  6.0 &  6.0, Sepn 0.050
24 19 16 44 d   1767 A2  7.6  75+ 120  -2 43 172  56N  81  56 +6.0 -4.2 +2.2+0.6
24 20 20 02 d 119325 K0  7.6  75+ 120 -10 42 194  69S 136 112 +5.9 -4.2 +1.3-1.6
25  0 33 48 D X54025 *6  6.0  76+ 122     12 257  23N  48  24 +5.2 -4.1 +0.8-0.3
26 21 03 39 d 139592 G5  7.7  90+ 143     35 180  81S 125 104 +3.7 -5.6 +1.5-0.9
27 23 49 14 d 158732 K2  7.7  95+ 155     25 213  77S 130 112 +2.0 -5.7 +1.4-1.7
28 20 46 07 d   2200 K0  7.5  98+ 164 -12 24 153  73S 137 123 +1.4 -5.8 +1.0-0.4
31  0 46 21 D X41940     0.0  99- 171     22 191 -24S 138 134 -1.8 -4.7 +1.7-1.4
      Distance of X41940 to Terminator =  1.9 ; to 3km sunlit peak =  0.0
```

```
31  1 51 52 R X41940     0.0  99- 171     18 207  75S 239 234 -2.0 -4.7 +1.6-0.3
      Distance of X41940 to Terminator = 11.2 ; to 3km sunlit peak =  3.7
```

1999 June

```
Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1 23 06 25 r   2720 F5  6.4  93- 150     14 145  88N 264 270 -3.8 -2.9 +1.4+1.3
 6  2 08 22 g   3275 K0  6.0  61- 103 -11 19 138   3S 162 185 -7.3 +2.8 +9.9+9.9
      Distance of   3275 to Terminator = 15.7 ; to 3km sunlit peak =  0.0
Graze of   3275 K0  nearby at Lat = +48.12 +0.18(E.Long   -7.90), CA =  2.8S
 6  2 08 33 Gr  3275 K0  6.0  61- 103 -11 19 138
Closest distance to graze path is   13km at azimuth 345
16 21 12 00 d  97990 F5  8.1  13+  42      5 289  74N  90  74 +6.1 +1.7 -0.2-1.2
17 21 04 15 d  98651 A2  8.9  21+  55 -12 13 277  42N  61  41 +6.7 +0.0 +0.3-0.8
17 21 17 29 D  98654cB9  7.9  21+  55     11 279  68S 131 111 +6.7 +0.0 -0.2-1.9
       98654 =  7.6 &  9.0, Sepn 44.9, PA  46
17 21 21 44 d  98658 K0  8.4  21+  55     10 280  86S 112  92 +6.7 +0.0 -0.1-1.6
17 21 38 00 D   1415yA1  6.3  21+  55      8 283  25N  44  24 +6.8 +0.0 +0.3-0.2
        1415 =  7.0 &  7.0, Sepn 0.100, PA  90: & 10.0, Sepn 41.200, PA  80
19 22 39 00 d   1645 F8  6.7  41+  80      8 271  32N  55  31 +6.7 -2.9 +0.3-0.7
20 23 24 13 d   1749 K3  6.0  52+  92      5 268  18S 186 161 +6.1 -4.0 -0.2-4.3
23 23 33 25 d   2072 K0  6.6  79+ 126     14 237  54N  75  57 +3.0 -5.8 +1.0-1.2
24 21 08 28 d   2167 K0  7.4  86+ 136 -12 28 191  15N  35  20 +2.2 -5.9 +4.4+3.9
25 19 32 52 d   2280 M1  6.5  92+ 146  -1 22 154  63N  81  70 +1.3 -5.7 +1.9+1.1
25 22 05 44 D   2291vF7  5.5  92+ 147     25 194  67S 131 120 +0.8 -5.6 +1.6-1.2
        2291 =  6.3 &  6.3, Sepn 0.050
29 22 23 45 r   2829 K2  6.7  99- 168     17 151  41N 305 314 -3.7 -1.9 +1.3+0.2
      Distance of   2829 to Terminator =  8.7 ; to 3km sunlit peak =  2.3
```

1999 July

```
Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1  1 29 02 r 163462 K0  6.9  96- 156     22 184  35S 202 217 -5.1 -0.4 +1.1+1.6
 1 22 42 37 r   3086 B9  6.2  91- 145     11 133  80N 265 283 -5.3 +1.0 +1.1+1.4
 3  1 06 57 r 164844 K5  7.4  84- 133     24 153  12S 174 196 -6.2 +2.6 +0.1+5.2
 3  2 03 13 d   3237vB8  4.3  84- 132 -11 27 167 -58N  39  62 -6.3 +2.6 +1.3+1.4
        3237 =  5.2 &  5.2, Sepn 0.050
 3  3 14 19 R   3237vB8  4.3  83- 132  -3 28 186  64N 277 299 -6.5 +2.6 +2.0-0.4
        3237 =  5.2 &  5.2, Sepn 0.050
 4  0 58 13 r 165373 K0  7.7  75- 121     22 137  28N 311 336 -6.4 +4.0 +1.7-0.1
 4  2 39 18 r 165395 A0  8.2  75- 120  -8 30 163  81N 258 283 -6.6 +4.0 +1.7+0.8
 5  2 28 17 r 146908 F8  7.6  65- 108  -9 30 146  44N 294 319 -6.4 +5.3 +1.9+0.3
 7  2 59 04 R 109952 K0  7.4  43-  82  -6 31 123  48N 289 312 -5.1 +7.1 +1.4+0.8
 8  0 40 05 r    346 A5  7.4  33-  70      4  83  69N 270 289 -4.0 +7.6 -0.0+1.3
 8  2 58 41 D    364 B9  4.3  32-  68  -6 27 108 -56N  35  54 -3.9 +7.5 +0.3+2.2
 8  3 54 13 R    364 B9  4.3  31-  68   1 35 121  62N 277 296 -4.0 +7.5 +1.2+1.1
 9  1 49 56 R  93398 F5  7.3  22-  55     10  83  43N 298 313 -2.5 +7.6 +0.2+0.9
 9  2 14 18 r  93404 F8  8.8  22-  55 -11 14  87  63S 224 239 -2.5 +7.6 -0.1+2.0
 9  3 28 39 R    491 K0  6.0  21-  55  -2 26 101  53N 288 303 -2.4 +7.5 +0.8+1.0
 9  5 47 34 d    508vK0  4.1  20-  54  19 46 133 -62S  99 113 -2.5 +7.3 +1.5+0.6
          508 =  4.5 &  6.5, Sepn 0.011
 9  6 48 19 R    508vK0  4.1  20-  53  29 53 154  55S 217 231 -2.6 +7.3 +1.0+2.1
          508 =  4.5 &  6.5, Sepn 0.011
10  1 58 28 R    635 G8  3.7  13-  42      5  72  86S 250 260 -0.8 +7.1 -0.3+1.4
Graze of    669vG7  nearby at Lat = +49.78 +0.48(E.Long   -7.90), CA = -1.7S
10  5 06 49 Gr   669vG7  3.8  12-  40  13 35 107
Closest distance to graze path is  159km at azimuth 324
10  5 43 55 r    667vK2  5.0  11-  40  18 41 114  73N 272 281 -0.7 +6.8 +1.1+1.1
          667 =  5.4 &  7.9, Sepn 0.024, PA 238
10  6 25 25 r    677xA6  4.8  11-  39  25 47 125  36S 201 209 -0.7 +6.7 +0.3+3.2
          677 =  5.6 &  5.6, Sepn 0.020, PA 344
10  8 55 08 M    692 K5  0.9  11-  38  49 59 181   0S 165 173 -1.0 +6.6 +9.9+9.9
      Distance of    692 to Terminator =  2.7 ; to 3km sunlit peak =  0.0
          692 =  1.1 & 11.3, Sepn %132.4, PA  32: & 13.6, Sepn 30.800, PA 110
          692 = Alpha TAU,  0.75 +/- 0.95V, Var Type LB:
Graze of    692 K5  nearby at Lat = +48.34 +0.20(E.Long   -7.90), CA =  0.2S
```

```
10  8 55 20 Gr   692 K5  0.9  11-  38  49 58 181
Closest distance to graze path is   37km at azimuth 343
11  5 23 15 d    832 M2  4.3   5-  26  15 30  95 -82S  86  88 +1.2 +5.9 +0.5+1.4
        832 = CE TAU,  4.23 to  4.54V, Var Type SRC
11  6 24 25 R    832 M2  4.3   5-  25  25 40 108  82S 249 251 +1.2 +5.8 +0.7+1.7
        832 = CE TAU,  4.23 to  4.54V, Var Type SRC
11  6 53 13 r    836 B2  5.7   5-  25  29 44 114  56S 223 225 +1.1 +5.7 +0.6+2.4
19 20 56 04 d 139316 K0  7.7  45+  84     17 242  81S 121  98 +4.9 -5.5 +0.7-2.0
19 21 08 04 D   1923 K0  6.8  45+  84     16 245  37N  58  36 +4.9 -5.5 +1.0-0.8
21 19 09 32 d   2128 G7  5.8  64+ 106   0 29 192  75N  93  76 +3.1 -6.0 +1.9-0.5
21 21 53 39 d   2135 M5  7.1  64+ 107     15 232  53S 145 129 +2.6 -6.0 +1.0-2.4
        2135 = FY LIB,  7.06 to  7.78V, Var Type SRB
25 21 09 18 D   2633tB2  3.8  94+ 150     21 175  41S 142 144 -2.0 -3.5 +1.6-1.0
        2633 =  4.1 &  7.0, Sepn 0.011: & 11.5, Sepn 16.900, PA 258
        2633 = Miu SGR,  3.80 to  3.88V, Var Type EA+ACYG, Phase .44
25 22 00 50 D   2638 B0  5.3  94+ 151     21 188  49N  52  55 -2.2 -3.5 +1.8+0.5
25 22 06 50 r   2633tB2  3.8  94+ 151     21 189 -42S 225 228 -2.2 -3.5 +1.8+0.7
        2633 =  4.1 &  7.0, Sepn 0.011: & 11.5, Sepn 16.900, PA 258
        2633 = Miu SGR,  3.80 to  3.88V, Var Type EA+ACYG, Phase .44
26 23 15 42 D   2797cF2  2.9  98+ 162     20 194  69S 110 118 -3.4 -2.3 +1.9-0.9
        2797 =  3.8 &  3.8, Sepn 0.100, PA 150
27  0 29 20 R   2797cF2  2.9  98+ 163     15 211 -59S 238 246 -3.6 -2.2 +1.1-0.3
        2797 =  3.8 &  3.8, Sepn 0.100, PA 150
28 23 47 40 r   3058 K0  5.8 100- 174     24 177  48N 302 320 -4.9 +0.6 +2.2-0.7
      Distance of   3058 to Terminator =  2.7 ; to 3km sunlit peak =  0.0
31  0 28 46 r 165228 K3  7.9  93- 150     29 161  82N 262 285 -5.4 +3.7 +1.7+0.7
```

1999 August

```
Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1  3 09 26 r 146801tA3  7.9  86- 136  -8 34 193  51S 212 237 -5.6 +5.0 +1.0+1.2
      146801 =  8.7 &  8.7, Sepn 0.090, PA 399: & 11.4, Sepn 21.700, PA 302
 1 23 00 57 r     44 F8  7.4  79- 125     16 114  48S 208 233 -4.7 +6.2 +0.5+2.4
 1 23 08 51 r 128707 K0  6.9  79- 125     17 115  37N 303 328 -4.7 +6.2 +1.0+0.7
 2  0 24 17 r 128734 G5  7.8  79- 125     27 131  45S 205 229 -4.8 +6.2 +0.7+2.3
 3  1 20 01 r 109787 K0  7.5  68- 112     32 130  25S 185 208 -4.2 +7.0 +0.1+3.2
 3  1 41 46 R 109783cG5  7.3  68- 111     35 136  72S 232 255 -4.3 +7.0 +1.0+1.8
      109783 =  6.9 &  9.5, Sepn 36.9, PA 100
 4 23 49 12 R    444 K6  5.9  47-  86     10  85  50N 293 310 -2.3 +7.7 +0.2+1.0
 5  0 46 03 r  93249 F0  8.1  46-  86     19  95  61N 283 299 -2.2 +7.6 +0.5+1.2
 5  1 00 42 r  93253 K5  8.3  46-  85     22  98  90S 253 270 -2.2 +7.6 +0.4+1.7
 5  1 18 05 r  93264 G0  8.1  46-  85     24 101   9S 173 189 -2.2 +7.6 -1.2+4.9
 5  5 03 42 r    462kB8  6.0  44-  84   8 53 163  50N 294 309 -2.5 +7.4 +2.2-0.7
        462 =  6.7 &  6.7, Sepn 0.100, PA  90
 6  3 00 23 R  93746 G5  8.0  34-  71 -11 35 108  75N 272 283 -1.0 +7.1 +0.9+1.3
 7  0 22 17 R    741xK1  5.5  24-  59      3  67  59S 230 236 +0.3 +6.6 -0.5+1.6
        741 =  6.5 &  6.5, Sepn 0.080, PA 240
 7  3 01 21 r X 6475 K0  8.8  23-  58 -11 28  94  50S 221 226 +0.4 +6.4 +0.1+2.3
 8  1 41 23 R  95127kA0  7.2  14-  45      7  69  67S 242 241 +1.7 +5.4 -0.4+1.6
       95127 =  8.4 &  8.4, Sepn 0.020, PA   0
 8  1 58 14 r  95142 K0  8.8  14-  45     10  72  50N 306 305 +1.8 +5.4 +0.1+0.6
 8  2 47 47 r  95183mA5  8.9  14-  44     17  80  74N 282 281 +1.8 +5.3 +0.2+1.1
       95183 =  9.1 & 11.1, Sepn 0.400, PA  87
 9  3 19 03 r  96507 F5  8.4   7-  30  -9 13  75  39S 220 212 +3.1 +3.8 -0.5+2.4
14 19 57 53 d   1767 A2  7.6  13+  42 -12  4 268  86N 105  81 +5.2 -4.4 +0.1-1.7
15 19 59 12 d 139144 F0  8.4  20+  53      8 257  29N  48  25 +4.7 -5.2 +0.5-0.4
16 20 01 50 d 139592 G5  7.7  29+  65     11 247  26S 173 152 +4.0 -5.7 +0.5-3.4
18 18 53 09 d   2200 K0  7.5  47+  87  -3 23 209  37S 158 144 +2.1 -5.9 +1.2-2.4
22 18 56 55 d 187214 K2  7.3  83+ 131  -5 19 162  76N  74  79 -2.6 -2.8 +1.8+0.9
22 19 22 35 D   2720 F5  6.4  83+ 131  -9 20 168  82N  79  85 -2.7 -2.8 +1.8+0.6
23 20 41 40 d 188421 M1  7.7  90+ 143     21 175  81S  91 102 -3.9 -1.4 +1.8+0.2
27 22 48 44 r 146570mF0  7.8  99- 168     30 154  84N 271 295 -4.9 +4.6 +1.7+0.7
      146570 =  8.4 &  9.4, Sepn 0.723, PA  33
27 23 12 40 r 146577aF9  7.6  99- 167     31 161  78S 252 276 -4.9 +4.6 +1.5+0.9
      146577 =  8.3 &  9.4, Sepn 25.2, PA 176
29  3 25 38 r 128642 M*  7.4  95- 153     31 220  64N 281 306 -4.8 +5.7 +1.6-1.5
Graze of 128661 M0  nearby at Lat = +48.75 +0.28(E.Long   -7.90), CA = 11.2N
29  4 16 33 Gr128661 M0  6.6  94- 153  -5 25 232
```

```
Closest distance to graze path is   77km at azimuth 337
29  4 26 00 r 128661 M0  6.6  94- 153  -3 24 234  27N 318 343 -4.9 +5.7 +2.5-6.6
29 22 11 12 r    126 K0  7.6  90- 142     22 116  74N 271 294 -3.4 +6.8 +0.9+1.4
31  3 44 39 R    291kG5  6.8  80- 127 -10 47 199  55S 219 240 -2.9 +7.2 +1.1+1.2
         291 =  7.9 &  7.9, Sepn 0.100, PA  90


                                   1999  September

Day  Time    P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1  3 52 37 r  93186 F0  7.8  70- 113  -9 52 183  38S 204 220 -1.7 +7.3 +0.9+2.4
 2  4 29 34 r    576aG5  7.9  59- 100  -4 56 176  48S 217 229 -0.4 +7.0 +1.2+2.0
         576 =  8.1 & 11.6, Sepn  8.6, PA 103
 3  3 53 00 R    729 F8  7.1  47-  87 -10 53 138  47S 220 226 +0.9 +6.4 +0.9+2.4
 3  4 01 41 r  94157 F2  8.7  47-  87  -8 54 141  63N 290 296 +0.9 +6.3 +1.8-0.1
 4  0 21 31 r  94784 F2  8.1  37-  75     14  77  62S 239 240 +2.2 +5.6 -0.2+1.8
 4  0 21 50 r    862 K0  7.3  37-  75     14  77  51N 307 307 +2.2 +5.6 +0.3+0.6
 4  0 33 53 R    863 B9  6.7  37-  75     16  79  58N 299 300 +2.2 +5.6 +0.3+0.8
 4  1 10 45 R  94814 A0  7.5  37-  75     22  86  75S 252 253 +2.2 +5.6 +0.1+1.7
 4  1 21 36 R    871 G8  6.7  37-  75     24  88  34S 211 212 +2.2 +5.5 -0.2+2.7
 4  1 44 35 R  94839 B9  7.5  37-  74     27  92  50S 227 228 +2.2 +5.5 +0.1+2.2
 4  1 57 07 R  94840tF2  7.6  36-  74     29  94  62S 240 240 +2.2 +5.5 +0.3+2.0
       94840 =  7.7 & 10.8, Sepn  3.9, PA  20: & 13.0, Sepn  9.700, PA 233
 4  3 47 33 r  94899 K0  8.1  36-  73 -11 47 118  35S 213 213 +2.1 +5.3 +0.5+3.1
 4  3 58 06 R    884kA5  7.8  36-  73  -9 48 120  87S 265 265 +2.1 +5.3 +1.2+1.2
         884 =  8.6 &  8.6, Sepn 0.050, PA  90
 4  3 59 48 r  94913 K0  8.7  36-  73  -9 48 121  26S 204 204 +2.1 +5.3 +0.4+3.8
Graze of    913lB8  nearby at Lat = +47.01 -0.27(E.Long   -7.90), CA = -2.7N
 4 10 28 30 Gr   913lB8  5.1  33-  71  48 36 260
Closest distance to graze path is  102km at azimuth 202
 5  0 32 36 r  96023 K0  8.4  26-  62      7  69  76N 287 281 +3.2 +4.3 -0.1+0.9
 5  1 23 34 r  96058kF0  8.1  26-  61     15  78  81S 263 258 +3.2 +4.2 -0.0+1.4
       96058 =  8.7 &  8.7, Sepn 0.050
 5  1 52 17 r  96087 K2  8.9  26-  61     20  82  59S 241 236 +3.2 +4.2 -0.0+1.9
 5  2 15 26 r X 9794 F8  8.8  26-  61     23  86  77S 260 254 +3.2 +4.1 +0.2+1.6
 5  2 51 14 r  96133 F8  9.0  25-  61     29  93  38S 221 215 +3.2 +4.1 +0.0+2.7
 5  3 54 37 r  96181 A   9.1  25-  60 -10 39 105  68S 252 245 +3.2 +4.0 +0.7+1.8
 6  2 14 25 r  97227 K0  9.3  16-  48     14  77  84S 272 261 +4.1 +2.6 +0.0+1.3
 6  2 21 27 R  97234mA0  8.3  16-  48     15  78  55S 244 232 +4.1 +2.6 -0.2+1.9
       97234 =  8.6 &  8.6, Sepn 0.180, PA  77
 6  2 26 34 r  97236 F5  9.2  16-  48     15  79  68S 256 245 +4.1 +2.6 -0.0+1.6
 6  2 31 51 r  97245 A2  8.7  16-  48     16  80  68N 301 289 +4.1 +2.6 +0.3+0.6
 6  3 53 24 r  97305 K5  8.9  16-  47 -10 29  94  21S 210 198 +4.1 +2.4 -0.2+4.0
 7  3 15 26 r  98123 A2  9.2   9-  34     13  79  79S 274 257 +4.9 +0.9 +0.0+1.3
 7  3 41 20 r X13385 K0  9.4   9-  34     17  83  59S 253 236 +4.9 +0.8 +0.0+1.8
 7  3 51 20 r X13398 G   9.3   8-  34 -11 19  85  68N 307 290 +4.9 +0.8 +0.4+0.4
 7  4 32 57 r  98159 A3  8.0   8-  34  -4 25  92  74N 300 283 +4.9 +0.7 +0.6+0.5
 8  3 21 08 R   1434 M2  5.4   3-  21      3  73  68S 268 248 +5.4 -0.8 -0.2+1.3
14 18 13 58 d   2158 A0  7.5  22+  56  -6 16 229  65N  78  63 +2.1 -5.8 +1.2-1.2
15 20 09 18 d   2280 M1  6.5  31+  68      4 241  25N  35  24 +0.7 -5.5 +0.1+0.3
16 18 47 39 d 160069 K2  7.5  40+  78 -12 17 214  75N  82  75 -0.4 -5.0 +1.5-1.0
19 18 54 40 d 187920 K0  7.4  68+ 111     21 181  64S 109 118 -4.0 -1.9 +1.9-0.4
21 20 06 05 D Uranus     5.7  85+ 135     24 173  21N   4  22 -5.6 +1.0 +0.5+3.3
   Duration of Partial Stage for Disk =  28 secs
21 22 05 24 D   3086 B9  6.2  86+ 135     22 203  88N  71  89 -6.0 +1.0 +1.4-0.3
22 22 32 32 d   3224 K0  7.6  92+ 148     26 198  88S  69  90 -6.2 +2.5 +1.4-0.1
22 22 33 01 d 164808 F8  7.7  92+ 148     26 199  34N  10  32 -6.2 +2.5 +0.3+2.0
23  1 29 10 D   3237vB8  4.3  93+ 149      8 238  77S  79 102 -6.5 +2.5 +0.6-1.1
       3237 =  5.2 &  5.2, Sepn 0.050
23 22 48 19 d 165373 K0  7.7  97+ 160     31 190  68N  37  61 -6.0 +4.0 +1.1+1.0
24 22 45 43 d 146908 F8  7.6 100+ 172     36 175  83S  42  67 -5.3 +5.3 +1.2+1.2
      Distance of 146908 to Terminator =  9.0 ; to 3km sunlit peak =  2.5
26 21 55 28 r 109952 K0  7.4  97- 160     34 128  84N 270 292 -2.8 +7.1 +1.2+1.2
27  0 17 15 r    236aK0  7.9  97- 159     46 171  54N 299 321 -3.0 +7.0 +2.5-1.2
         236 =  7.9 & 11.6, Sepn  5.1, PA 197
27 21 08 54 d    364 B9  4.3  92- 147     22 103 -65N  56  75 -1.2 +7.5 +0.3+1.9
27 22 09 53 R    364 B9  4.3  92- 146     32 116  87S 257 276 -1.2 +7.4 +0.8+1.5
27 22 53 59 r 110568 G5  8.1  91- 146     38 126  60S 230 249 -1.3 +7.4 +0.8+1.9
28  1 29 07 r 110616 F2  7.7  91- 145     51 177  53S 223 241 -1.5 +7.2 +1.2+1.5
```

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28 21 43 07 R    491 K0  6.0  84- 133     23  96  88S 259 273 +0.3 +7.3 +0.4+1.6
28 21 55 45 r  93422 A0  7.4  84- 133     24  99  38S 209 223 +0.3 +7.3 +0.0+2.4
28 23 03 51 R    498vA0  6.3  84- 132     35 112  49S 220 234 +0.3 +7.2 +0.4+2.2
         498 =  7.0 &  7.0, Sepn 0.050
29  0 14 46 D    508vK0  4.1  83- 132     45 130 -24S 147 161 +0.2 +7.2 +4.4-5.2
         508 =  4.5 &  6.5, Sepn 0.011
29  0 17 47 r  93461 G5  8.2  83- 132     46 131  14S 185 198 +0.2 +7.1 -0.2+4.0
Graze of    508vK0  nearby at Lat = +47.53 +0.50(E.Long   -7.90), CA =-13.4S
29  0 20 30 Gr   508vK0  4.1  83- 132     46 131
Closest distance to graze path is   42km at azimuth 144
29  0 28 05 R    508vK0  4.1  83- 132     47 134  -3S 168 182 +0.2 +7.1 -2.3+8.4
         508 =  4.5 &  6.5, Sepn 0.011
Graze of    516kG5  nearby at Lat = +47.11 +0.34(E.Long   -7.90), CA = 12.4N
29  2 15 20 Gr   516kG5  6.9  83- 131     57 173
Closest distance to graze path is   89km at azimuth 154
29  2 15 58 M    516kG5  6.9  83- 131     56 173  12N 339 352 +0.1 +7.0 +9.9+9.9
         516 =  8.1 &  8.1, Sepn 0.100, PA  90
29 20 21 55 R    635 G8  3.7  75- 120      3  70  32S 205 215 +1.7 +6.9 -0.6+2.1
29 23 20 06 d    667vK2  5.0  74- 119     31 101 -81S  93 101 +1.8 +6.7 +0.7+1.3
         667 =  5.4 &  7.9, Sepn 0.024, PA 238
30  0 19 55 R    667vK2  5.0  74- 118     41 114  57S 231 240 +1.8 +6.6 +0.6+2.1
         667 =  5.4 &  7.9, Sepn 0.024, PA 238
30  3 54 08 R  94019 K5  6.7  72- 117     59 191  38N 316 324 +1.4 +6.3 +2.2-3.3
30  4 03 46 R  94018 K3  7.2  72- 117     58 196  90N 265 272 +1.4 +6.3 +1.6-0.1
30 22 15 16 r  94510 K5  7.3  64- 106     14  77  68N 290 292 +3.1 +5.8 +0.1+1.0
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1999 October

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Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
Graze of    832 M2  nearby at Lat = +51.36 +0.34(E.Long   -7.90), CA =-10.2S
 1  1 38 27 Gr   832 M2  4.3  62- 104     44 120
Closest distance to graze path is  328km at azimuth 331
 1  2 16 50 R  94634 F7  7.5  62- 104     51 127  55N 303 305 +3.0 +5.4 +1.8-0.5
 1  4 28 18 r  94687 F5  8.5  61- 103 -11 61 181  82N 276 278 +2.7 +5.3 +1.7-0.3
 1  4 30 42 r  94694 K0  7.8  61- 103 -10 61 182  42S 221 222 +2.7 +5.3 +1.4+2.2
 2  1 49 26 r  95789 K2  8.3  51-  91     40 105  75N 289 284 +4.2 +4.2 +1.1+0.7
 2  1 49 47 r  95790 G5  7.9  51-  91     39 105  62S 245 241 +4.2 +4.2 +0.7+1.9
 2  2 29 07 r  95822 B8  8.0  50-  90     46 114  82S 265 260 +4.1 +4.1 +1.1+1.3
 2  5 04 35 r  95928mG   8.6  49-  89  -5 62 170  71S 255 250 +3.8 +4.0 +1.6+0.7
       95928 =  9.4 &  9.4, Sepn 0.700, PA 270
 3  0 36 23 R   1135 K0  6.7  40-  78     18  81  46N 323 313 +5.1 +2.9 +0.7-0.2
 4  0 46 04 r  97833 F5  7.9  29-  65     10  74  56N 317 302 +5.7 +1.3 +0.3+0.1
 4  1 59 33 G   1275xK5  5.3  29-  65     21  86  10N   4 349 +5.7 +1.1 +9.9+9.9
       1275 =  6.4 &  6.4, Sepn 0.100, PA 100
Graze of   1275xK5  nearby at Lat = +48.08 +0.26(E.Long   -7.90), CA =  9.5N
 4  1 59 38 Gr  1275xK5  5.3  29-  65     21  86
Closest distance to graze path is    8km at azimuth 339
 4  2 16 36 r  97872 K0  8.8  28-  65     24  90  77N 296 281 +5.6 +1.1 +0.6+0.7
 4  2 21 56 r  97877 A2  9.1  28-  64     25  91  65N 309 293 +5.6 +1.1 +0.7+0.3
 4  2 42 28 r  97887 G5  8.7  28-  64     28  94  84S 277 262 +5.6 +1.1 +0.6+1.2
 4  3 30 38 r  97911 K0  9.0  28-  64     36 104  50S 244 228 +5.6 +1.0 +0.7+2.3
 4  3 43 27 r  97914kF2  8.8  28-  64     38 107  88S 282 267 +5.6 +1.0 +1.0+0.9
       97914 =  9.6 &  9.6, Sepn 0.100, PA  90
 4  4 26 31 r  97940 F5  8.9  28-  64 -12 45 117  60N 314 298 +5.5 +0.9 +1.3-0.6
 5  2 10 13 r  98570kG   9.2  19-  52     13  81  57S 256 236 +6.0 -0.5 -0.0+1.8
       98570 =  9.8 &  9.8, Sepn 0.100, PA  90
 5  2 19 23 r X14319 F8  9.0  19-  52     14  83  71N 308 288 +6.0 -0.5 +0.3+0.4
 5  2 58 45 R  98590 G0  8.5  19-  52     20  90  83S 282 262 +6.0 -0.5 +0.4+1.1
 5  3 00 04 r  98599 G   8.7  19-  52     21  90  27N 351 331 +6.0 -0.5 +1.2-3.6
 5  3 45 17 r  98610 G0  9.0  19-  51     28  98  52N 327 307 +6.0 -0.6 +0.9-0.7
 5  3 48 31 R  98613 F8  8.4  19-  51     28  99  52N 327 307 +6.0 -0.6 +0.9-0.8
       98613 =  8.9 &  8.9, Sepn 0.100, PA 120
 5  3 57 39 r  98611 G   8.9  19-  51     30 101  47S 246 226 +5.9 -0.6 +0.6+2.3
 6  3 21 17 r  99089 F0  9.0  11-  39     13  87  41S 244 222 +6.1 -2.1 +0.0+2.4
 6  4 24 37 r  99101 K0  8.9  11-  39     23  99  42S 245 223 +6.1 -2.1 +0.5+2.5
14 12 18 44 D X41940     0.0  23+  57  32 13 140  79S 105 100 -0.2 -4.5 +1.1+0.9
14 13 39 13 R X41940     0.0  23+  57  26 20 159 -76N 287 283 -0.4 -4.4 +1.5+0.4
14 17 35 50 d 160397 M1  8.4  24+  58 -10 15 215  72N  75  72 -1.3 -4.3 +1.4-0.9
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15 17 41 38 d 186257 A0  8.7  32+  69 -11 17 205  78S 100 102 -2.6 -3.3 +1.7-1.1
15 18 56 33 d 186305 F8  7.7  33+  70     10 221  63S 116 118 -2.8 -3.3 +1.4-1.8
15 19 44 11 d 186341 WC  7.7  33+  70      5 231  44S 134 136 -3.0 -3.3 +1.4-2.6
16 18 46 56 D   2759 G8  3.5  42+  80     16 209  31N  25  33 -4.1 -2.1 +0.7+1.0
16 19 29 27 R   2759 G8  3.5  42+  81     12 219 -33N 321 328 -4.2 -2.1 +2.1-3.0
19 18 46 20 d   3157mF6  7.2  71+ 114     26 173  60N  40  61 -6.8 +2.1 +1.4+1.2
        3157 =  7.1 & 10.5, Sepn 0.750, PA  20
20 17 45 05 d 165049 M3  7.7  79+ 126     22 145  51S 106 129 -6.8 +3.5 +1.5+0.8
20 17 56 09 d 165053 K2  7.8  79+ 126     23 147  83N  60  83 -6.8 +3.5 +1.3+1.5
21 17 12 14 D   3419aK0  4.2  87+ 138  -8 16 124  60S  93 118 -6.5 +4.8 +0.9+1.3
        3419 =  4.5 &  8.5, Sepn 49.6, PA 312
21 18 16 17 r   3419aK0  4.2  87+ 138     24 139 -71S 224 248 -6.6 +4.8 +1.1+1.8
        3419 =  4.5 &  8.5, Sepn 49.6, PA 312
22 20 30 21 d     25 G6  7.4  94+ 152     36 159  20S 127 152 -6.0 +6.0 +2.8-1.1
      Distance of     25 to Terminator = 15.4 ; to 3km sunlit peak =  5.5
23  0 49 36 d 128707 K0  6.9  95+ 154     25 233  42S 105 129 -6.5 +5.9 +1.3-1.9
23  2 48 17 d     49 K1  6.1  95+ 155      8 257  76N  43  67 -6.5 +5.8 +0.2-0.0
24  1 57 07 d    188 F0  7.6  99+ 167     28 240  62N  17  40 -5.2 +6.6 +0.5+1.6
      Distance of    188 to Terminator = 18.2 ; to 3km sunlit peak =  8.0
24 22 15 48 d    306 F0  6.8 100- 174     47 155  78N 345   6 -3.1 +7.2 -2.0+7.2
      Distance of    306 to Terminator =  4.4 ; to 3km sunlit peak =  0.4
Graze of    306 F0  nearby at Lat = +48.62 +0.53(E.Long   -7.90), CA = 89.8N
24 22 24 04 Gr   306 F0  6.8 100- 174     47 158
Closest distance to graze path is   54km at azimuth 321
24 22 30 59 r    306 F0  6.8 100- 174     48 161  78S 321 341 -3.1 +7.2 +4.6-5.1
      Distance of    306 to Terminator =  4.4 ; to 3km sunlit peak =  0.4
25 20 43 10 r    444 K6  5.9  98- 165     33 112  16S 201 217 -1.0 +7.3 +0.1+2.6
      Distance of    444 to Terminator =  2.4 ; to 3km sunlit peak =  0.0
26  0 04 24 R    453xM1  7.1  98- 164     54 174  59S 242 258 -1.2 +7.0 +1.4+1.0
        453 =  8.1 &  8.1, Sepn 0.100, PA  54
26 23 42 17 r  93757vG0  8.2  93- 150     52 142  65S 244 254 +0.9 +6.6 +1.2+1.4
       93757 =  9.0 &  9.0, Sepn 0.200, PA  75
26 23 57 08 r  93760 G0  7.9  93- 150     54 147  81N 277 288 +0.9 +6.6 +1.6+0.4
27  2 29 18 R    618vA0  7.2  93- 149     55 210  77S 255 265 +0.6 +6.4 +1.5+0.0
        618 =  7.3 & 10.0, Sepn 0.058, PA  77
27  5 25 28 R    627 K1  6.6  92- 148  -7 32 259  69S 247 256 +0.5 +6.3 +0.8-0.6
27 22 18 49 r  94294kA2  7.6  86- 137     35 102  85N 275 280 +2.9 +5.8 +0.8+1.2
       94294 =  8.7 &  8.7, Sepn 0.100, PA  90
28 20 48 30 R    913lB8  5.1  78- 124     12  74  76N 287 285 +4.5 +4.8 +0.0+1.0
        913 =  6.3 &  6.3, Sepn 0.001: &  6.5, Sepn  0.060, PA  76
28 23 26 13 r  95307 F0  8.1  77- 122     37 102  47S 230 228 +4.5 +4.5 +0.4+2.3
29  0 27 12 R    940cB9  5.8  77- 122     46 115  56S 239 237 +4.4 +4.4 +0.8+2.0
        940 =  5.7 &  9.2, Sepn 90.0, PA 206
29  0 56 28 r  95383 A9  8.3  76- 122     51 123  54S 238 235 +4.4 +4.3 +1.0+2.0
29  0 57 48 r  78111 A5  8.4  76- 122     51 123  71N 292 290 +4.4 +4.3 +1.5+0.2
29  4 37 21 r  95544 G5  7.7  75- 120     58 216  35S 219 216 +4.0 +4.1 +1.7+1.9
29  5 09 56 r  95562 G5  8.2  75- 120 -10 54 228  50S 234 231 +4.0 +4.1 +1.6+0.7
29  5 23 53 R    971kG5  7.3  75- 120  -8 53 232  41S 226 222 +3.9 +4.1 +1.6+1.1
        971 =  7.5 &  9.5, Sepn 0.050, PA 320
29  8 06 21 d    995bB6  4.1  74- 119  16 28 269 -38N  43  39 +3.8 +4.1 +1.0+0.2
        995 =  4.3 &  6.0, Sepn 0.200, PA 139: &  8.6, Sepn %112.500, PA 329
29  8 42 53 r    995bB6  4.1  74- 118  20 22 276  39N 326 322 +3.8 +4.1 -0.3-2.9
        995 =  4.3 &  6.0, Sepn 0.200, PA 139: &  8.6, Sepn %112.500, PA 329
29 22 59 09 r  96588 F5  7.8  66- 109     23  86  57S 245 237 +5.8 +3.1 +0.1+1.9
29 23 33 47 r  96610mA2  8.0  66- 109     29  92  71S 259 251 +5.8 +3.0 +0.4+1.6
       96610 =  8.0 &  9.6, Sepn 0.440, PA  89
30  0 29 41 r  96669 F8  8.0  66- 109     37 102  10S 198 190 +5.8 +2.9 -0.3+5.4
30  1 20 22 R  96697 B9  7.5  66- 108     45 114  54S 242 233 +5.7 +2.8 +0.9+2.1
30  3 51 11 r  79298 B9  8.2  65- 107     62 167  64N 305 296 +5.4 +2.6 +1.6-1.3
31  1 34 02 R   1245mK0  7.5  54-  95     38 105  87S 280 266 +6.6 +1.2 +0.9+1.0
        1245 =  7.5 & 10.5, Sepn  4.0, PA 340
31  5 40 14 R   1259 A9  5.9  53-  93  -6 60 192  64S 258 243 +6.1 +1.0 +1.8+0.3
31  9 52 46 r   1275xK5  5.3  51-  92  26 28 266  53N 321 306 +5.7 +1.0 +0.0-2.4
        1275 =  6.4 &  6.4, Sepn 0.100, PA 100
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1999 November

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Day  Time    P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D        ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
```

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Graze of  98430mA0  nearby at Lat = +48.17 +0.21(E.Long   -7.90), CA =  9.3N
 1  0 48 07 Gr 98430mA0  7.8  44-  83     20  87
Closest distance to graze path is   18km at azimuth 342
 1  0 51 51 r  98430mA0  7.8  43-  83     21  88  17N   0 342 +7.2 -0.3 +9.9+9.9
       98430 =  8.1 &  8.6, Sepn  1.8, PA  54
 1  2 29 02 r  98453 F5  8.3  43-  82     36 107  43S 241 222 +7.1 -0.5 +0.8+2.6
 1  5 27 23 r  98504 G5  8.6  42-  81  -8 57 162  86N 292 273 +6.7 -0.6 +1.6-0.5
 2  1 14 52 r   1481 A5  7.4  33-  70     13  86  27S 228 207 +7.4 -1.9 -0.2+3.2
 2  1 46 12 r  98959 F8  8.4  33-  70     19  91  81N 301 279 +7.4 -1.9 +0.4+0.6
 2  3 13 26 r X15300 F   8.7  32-  69     32 108  63N 319 297 +7.2 -2.0 +0.9-0.4
 3  3 36 14 r 118624 G5  9.1  23-  57     25 106  84N 301 277 +7.2 -3.3 +0.7+0.4
 3  3 40 19 r 118626 F8  9.2  23-  57     26 107  38S 242 219 +7.2 -3.3 +0.8+2.9
 3  4 28 42 R 118637 F5  8.5  22-  56     33 117  86N 299 275 +7.1 -3.4 +1.0+0.3
 4  3 35 34 r X17740 K0  9.0  15-  45     15 100  72S 279 254 +6.9 -4.4 +0.4+1.2
 4  5 36 52 r 119107 K0  8.3  14-  44  -7 33 125  47S 254 230 +6.7 -4.5 +1.4+2.1
 5  3 29 16 r 119510 F5  8.5   8-  33      3  93  80N 309 285 +6.3 -5.3 +0.1+0.3
 5  5 47 03 r 138923 F5  8.0   8-  33  -6 24 120  74S 283 260 +6.2 -5.3 +0.9+1.0
10 17 00 53 d 160203 G5  8.5   6+  28 -11  5 233  63N  63  58 -0.5 -4.4 +0.6-0.9
11 17 34 10 d 185801 K5  8.1  11+  39      6 230  50N  48  48 -2.0 -3.4 +0.5-0.4
12 16 14 41 D   2704kA5  5.9  17+  49  -4 18 203  36N  31  37 -3.1 -2.3 +1.1+0.8
        2704 =  6.5 &  6.5, Sepn 0.100, PA 270
12 17 42 29 d 187119 B9  8.8  17+  49     10 222  78N  72  78 -3.4 -2.3 +1.0-0.9
12 17 45 31 d 187121 F8  8.8  17+  49      9 222  63S 112 117 -3.4 -2.3 +1.4-1.8
13 17 07 21 D   2851 A2  6.1  25+  60     17 204  67S 104 115 -4.6 -1.0 +1.8-1.1
13 17 12 32 d 188227 A0  8.8  25+  60     17 205  68S 103 113 -4.6 -1.0 +1.8-1.1
13 17 27 24 d 188223 G0  8.5  25+  60     16 208  27S 144 154 -4.7 -1.0 +2.6-3.2
13 17 38 46 D 188234 K3  7.3  25+  60     15 211  53N  44  54 -4.7 -1.0 +1.0+0.0
14 17 30 44 d 163501 G8  8.5  34+  71     20 198  62N  49  64 -5.9 +0.3 +1.3+0.2
14 18 13 36 d 189232 G0  8.5  34+  71     18 208  70S  97 112 -6.0 +0.3 +1.7-1.1
15 17 43 55 d 164228 K5  8.1  43+  82     24 190  66N  49  68 -6.9 +1.8 +1.4+0.5
15 18 55 23 D   3105 K0  6.1  44+  83     20 208  37N  20  39 -7.1 +1.8 +0.5+1.2
15 20 31 47 d   3115 F0  7.1  44+  83     11 229  47S 115 134 -7.4 +1.7 +1.5-2.4
16 16 48 21 d 164837 K0  7.9  53+  94 -10 26 163  40S 120 142 -7.4 +3.2 +2.2-0.2
16 17 52 36 D 164844 K5  7.4  53+  94     28 180  46N  26  48 -7.6 +3.2 +1.0+1.5
16 19 39 10 D   3240 A2  6.7  54+  95     23 208  50S 109 131 -7.9 +3.1 +2.0-1.6
18 18 55 59 D   3506kK4  6.1  74+ 119     35 170  43S 111 136 -7.8 +5.7 +2.3-0.5
        3506 =  7.1 &  7.1, Sepn 0.100, PA  90
19 23 40 38 d 128965 K0  7.6  84+ 133     25 237  46S 106 130 -7.5 +6.4 +1.2-2.1
20  0 31 19 D    106 K0  6.6  85+ 134     18 248  64S  88 112 -7.5 +6.4 +0.7-1.4
20 17 50 16 d 109952 K0  7.4  91+ 144     30 121  51N  21  44 -5.6 +7.2 +0.4+2.4
21 17 28 45 D    364 B9  4.3  96+ 157     22 102  86S  61  79 -3.9 +7.4 +0.4+1.8
21 18 29 14 r    364 B9  4.3  96+ 158     31 115 -75N 251 270 -3.9 +7.4 +0.8+1.6
21 20 36 05 d 110616 F2  7.7  97+ 159     47 148  53S  93 112 -4.0 +7.3 +1.6+0.6
22  2 30 52 D    405vF1  4.3  97+ 162     24 258  57S  89 107 -4.4 +7.0 +0.6-1.3
         405 =  4.5 &  8.5, Sepn 0.050, PA 133
22 20 48 20 d    516kG5  6.9 100+ 172     47 131  78N  21  35 -1.8 +6.9 +0.4+2.8
      Distance of    516 to Terminator =  8.7 ; to 3km sunlit peak =  2.3
         516 =  8.1 &  8.1, Sepn 0.100, PA  90
23 21 11 15 r  94018 K3  7.2  99- 170     45 119  37S 238 246 +0.5 +6.1 +0.8+1.8
      Distance of  94018 to Terminator =  5.3 ; to 3km sunlit peak =  0.7
23 21 17 58 R  94019 K5  6.7  99- 170     46 120  78S 278 286 +0.5 +6.1 +1.2+0.8
      Distance of  94019 to Terminator = 13.6 ; to 3km sunlit peak =  5.1
23 23 08 14 r  94047 F0  7.9  99- 169     58 158  68S 266 273 +0.4 +6.0 +1.5+0.5
      Distance of  94047 to Terminator = 13.9 ; to 3km sunlit peak =  5.3
23 23 46 34 r    705 K0  7.9  99- 169     59 175  68S 266 273 +0.3 +5.9 +1.6+0.2
      Distance of    705 to Terminator = 14.7 ; to 3km sunlit peak =  5.8
24 21 30 51 r  94739 B9  7.6  96- 156     40 106  47N 320 321 +2.7 +4.9 +1.8-1.0
24 23 17 31 r X 7454 A5  8.2  96- 156     55 135  62S 249 249 +2.6 +4.8 +1.2+1.4
25  3 47 01 R    888vB9  6.0  95- 154     47 243  84S 271 270 +2.3 +4.5 +1.1-1.1
         888 =  6.8 &  6.8, Sepn 0.050
25  3 47 57 r  94948 K0  7.8  95- 154     47 244  60S 247 247 +2.3 +4.5 +1.2-0.3
25  4 53 49 R    895uB2  5.9  95- 153     37 258  58S 245 244 +2.2 +4.5 +0.9-0.5
         895 =  6.1 &  8.3, Sepn 0.001
25 23 23 56 r  78769 B8  7.7  89- 142     48 117  48N 320 314 +4.7 +3.2 +1.7-1.3
26  1 03 00 r  78812aK0  8.3  89- 141     60 151  71S 259 253 +4.5 +3.1 +1.5+0.8
       78812 =  8.6 & 12.1, Sepn  6.7, PA 213
26  4 02 59 r  78915 B9  7.8  88- 140     54 231  72N 297 290 +4.2 +3.0 +1.2-1.7
26  4 49 26 r  78950 G5  8.1  88- 139     48 244  68N 300 293 +4.2 +3.0 +0.9-2.0
26  5 52 08 r  78986 A0  8.0  88- 139  -9 38 258  39S 228 221 +4.1 +3.0 +1.3+0.2
26 22 04 54 r  97275 K0  7.7  81- 128     26  89  55N 316 305 +6.3 +1.7 +0.8-0.1
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26 23 11 22 R   1186 K1  6.0  81- 128     36 101  18S 210 198 +6.3 +1.6 +0.1+4.2
26 23 31 56 r  97319 K5  8.3  81- 128     40 106  56S 248 236 +6.3 +1.6 +0.7+1.9
27 23 53 12 R   1327 F2  6.9  70- 114     32 100  57S 253 236 +7.4 -0.1 +0.6+1.9
28  0 10 09 R  98204 A0  7.2  70- 114     35 103  80N 296 278 +7.4 -0.1 +0.9+0.5
28  0 55 01 R   1331 *6  6.3  70- 114     42 113  42S 238 221 +7.4 -0.2 +1.0+2.6
        1331 = X CNC,  5.60 to  7.50V, Var Type SRB, Phase .42
28  1 37 20 R  98241 G5  7.6  70- 113     48 124  69N 307 289 +7.3 -0.2 +1.3-0.4
28  1 50 11 R   1335 K1  6.2  70- 113     49 128  39S 235 217 +7.3 -0.3 +1.4+2.7
28  4 35 15 R   1345vB9  7.4  69- 112     58 195  88S 285 267 +6.9 -0.3 +1.6-0.8
        1345 =  7.9 &  7.9, Sepn 0.050
29  4 11 40 r  98871 K0  8.2  58- 100     54 161  19S 219 198 +7.7 -1.9 +3.1+5.7
30  0 39 46 r  99272 K2  7.5  49-  88     18  94  55S 257 234 +8.3 -3.2 +0.3+1.9
30  2 11 30 r  99296 A3  8.0  48-  88     32 112  51N 331 308 +8.2 -3.2 +0.8-1.1
30  3 14 49 R  99302 A0  7.4  48-  87     41 128  89N 293 270 +8.1 -3.3 +1.2+0.3
```

1999 December

```
Day  Time   P  Star  Sp  Mag   % Elon Sun  Moon   CA   PA  WA Long  Lat   A   B
    h  m  s     No  D         ill     Alt Alt Az   o    o   o  Lib  Lib  m/o m/o
 1  1 45 21 R   1684 K0  6.8  38-  76     18 101  85S 290 265 +8.1 -4.4 +0.5+0.9
 1  1 45 22 R 118952 A2  7.1  38-  76     18 100  38N 346 322 +8.1 -4.4 +0.4-1.8
 1  2 53 30 R 118971 G5  7.6  37-  76     28 114  52N 332 308 +8.0 -4.4 +0.7-1.0
 1  3 13 50 r 118970 F8  8.6  37-  75     31 119  69S 273 249 +8.0 -4.4 +1.1+1.3
 1  3 42 56 r 118979 K0  8.5  37-  75     35 126  66N 318 294 +8.0 -4.4 +1.0-0.5
 1  5 28 15 r 119004 K0  8.5  37-  75     45 157  85N 299 275 +7.7 -4.4 +1.5-0.5
 1  6 28 29 r 119015 F8  8.6  36-  74  -5 47 178  48N 336 312 +7.5 -4.4 +0.9-2.2
 2  4 29 00 r 119422 G5  8.7  27-  63     31 129  77S 283 259 +7.5 -5.3 +1.2+0.8
Graze of 119442 G0  nearby at Lat = +48.67 -0.38(E.Long   -7.90), CA =  3.0S
 2  5 32 23 Gr119442 G0  8.5  27-  63     37 146
Closest distance to graze path is   64km at azimuth  30
 2  5 38 10 r 119448 G0  8.8  27-  63     39 148  41N 344 320 +7.3 -5.3 +0.6-2.1
 3  2 59 43 R 139236 M7  7.1  19-  52      8 104  29N 356 334 +6.9 -5.9 -0.1-2.7
      139236 = SW VIR,  6.40 to  7.90V, Var Type SRB
 3  4 06 54 r X35958     9.2  19-  52     18 117  72S 278 256 +6.8 -5.9 +0.8+1.2
 3  4 25 19 r 139249aG5  8.7  19-  52     21 121  57N 329 306 +6.8 -5.9 +0.5-0.7
      139249 =  8.8 & 13.3, Sepn  4.1, PA 205
 4  5 49 17 r X37315 A2  9.3  12-  40 -11 23 133  84N 302 282 +5.8 -6.1 +0.9+0.3
 5  5 10 05 r X38519     9.8   6-  29      8 118  78S 283 266 +4.8 -6.1 +0.6+1.1
 5  5 37 18 R X38543     9.4   6-  29     12 123  61N 324 307 +4.8 -6.0 +0.3-0.3
 5  5 49 59 r X38542     9.7   6-  29 -11 14 126  46S 251 235 +4.8 -6.0 +1.3+2.3
10 17 03 16 d X45738 G5  9.5   6+  29      6 229  53N  45  54 -3.6 -1.3 +0.4-0.2
10 17 04 31 d X45728     9.9   6+  29      6 229  37N  29  38 -3.6 -1.3 +0.1+0.5
10 17 08 27 D 187913 K4  8.2   6+  29      5 230  87S  84  93 -3.6 -1.3 +0.8-1.3
11 18 12 46 d   2938 F0  7.5  12+  41      4 233  35S 133 147 -5.1 +0.1 +1.7-3.4
12 17 57 47 d X49428     9.2  19+  52     13 222  74N  59  77 -6.2 +1.5 +0.8-0.5
12 19 20 10 D Mars       0.9  19+  52      3 238  82N  66  84 -6.4 +1.5 +0.5-0.9
   Duration of Partial Stage for Disk =  12 secs
13 15 50 19 D   3190jA5  2.9  27+  62  -3 26 181  63S  99 120 -6.8 +2.9 +2.1-0.2
        3190 =  3.2 &  5.2, Sepn 0.002
        3190 = Delta CAP,  2.81 to  3.05V, Var Type EA, Phase .86
13 16 25 28 d 164659 G3  8.1  27+  62  -8 26 190  56S 106 127 -6.9 +2.9 +2.2-0.8
13 17 01 34 R   3190jA5  2.9  27+  63     24 199 -56S 217 239 -7.1 +2.9 +1.0+0.6
        3190 =  3.2 &  5.2, Sepn 0.002
        3190 = Delta CAP,  2.81 to  3.05V, Var Type EA, Phase .91
14 17 56 05 d 165220 G0  8.7  36+  74     27 202  71S  88 111 -7.9 +4.2 +1.7-0.6
14 19 15 09 D   3327 K2  6.8  37+  75     20 222  30S 129 152 -8.1 +4.2 +2.5-3.9
15 21 58 32 d   3478 G5  6.4  48+  88      9 248  53S 104 129 -8.7 +5.4 +0.7-2.1
16 19 16 37 D     44 F8  7.4  58+  99     37 201  73S  83 107 -8.3 +6.4 +1.7-0.3
16 20 53 45 d 128734 G5  7.8  58+  99     28 227  56S  99 124 -8.5 +6.3 +1.4-1.6
17 22 16 30 d 109783cG5  7.3  69+ 113     28 238  35S 120 143 -8.0 +6.9 +1.4-3.2
      109783 =  6.9 &  9.5, Sepn 36.9, PA 100
17 23 06 30 d 109795 A5  7.6  70+ 113     21 249  54N  30  53 -8.0 +6.9 +0.5+0.7
18 16 01 31 D    291kG5  6.8  77+ 123  -4 27 113  50N  25  46 -6.2 +7.5 +0.3+2.4
         291 =  7.9 &  7.9, Sepn 0.100, PA  90
18 19 21 00 d 110334 F2  7.8  79+ 125     48 170  72N  48  69 -6.5 +7.3 +1.2+1.4
19 18 20 37 D    444 K6  5.9  87+ 138     43 131  43S 115 131 -4.8 +7.3 +1.8+0.2
19 21 31 21 D    453xM1  7.1  88+ 139     52 200  82S  75  91 -5.1 +7.1 +1.5+0.1
         453 =  8.1 &  8.1, Sepn 0.100, PA  54
19 23 58 31 D    462kB8  6.0  88+ 140     36 245  41S 117 132 -5.3 +7.0 +1.1-2.5
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         462 =  6.7 &  6.7, Sepn 0.100, PA  90
20 18 59 26 d    592 G5  7.7  94+ 152     45 122  32N  10  21 -2.8 +6.7 -0.1+3.6
20 21 15 23 d  93757vG0  8.2  95+ 153     57 170  52S 107 117 -3.0 +6.5 +1.8-0.5
       93757 =  9.0 &  9.0, Sepn 0.200, PA  75
20 21 27 04 d  93760 G0  7.9  95+ 153     58 175  87S  72  82 -3.0 +6.5 +1.5+0.7
20 23 54 43 D    618vA0  7.2  95+ 154     48 232  70S  89  99 -3.2 +6.4 +1.3-0.9
         618 =  7.3 & 10.0, Sepn 0.058, PA  77
21  2 39 53 D    627 K1  6.6  96+ 156     23 269  67S  92 102 -3.3 +6.3 +0.4-1.4
21 19 05 32 d  94294kA2  7.6  99+ 166     39 107  59S  97 102 -0.6 +5.7 +0.9+1.0
      Distance of  94294 to Terminator = 19.4 ; to 3km sunlit peak =  8.8
       94294 =  8.7 &  8.7, Sepn 0.100, PA  90
21 20 26 14 D    764oG4  4.9  99+ 167     51 127  77N  53  57 -0.6 +5.5 +0.9+1.9
         764 =  5.6 &  5.6, Sepn 0.150
22  3 41 33 d  94501 G0  7.6  99+ 170     25 271  61S  91  94 -1.0 +5.2 +0.4-1.3
      Distance of  94501 to Terminator = 10.5 ; to 3km sunlit peak =  3.3
23  4 02 54 d    995bB6  4.1 100- 174     33 264 -76N 107 103 +1.2 +3.7 +0.5-1.7
      Distance of    995 to Terminator =  5.5 ; to 3km sunlit peak =  0.0
         995 =  4.3 &  6.0, Sepn 0.200, PA 139: &  8.6, Sepn %112.500, PA 329
23  4 25 03 r    991 A2  6.2 100- 173     29 269  69N 321 317 +1.2 +3.7 -0.0-2.7
      Distance of    991 to Terminator =  5.4 ; to 3km sunlit peak =  0.8
23  4 59 39 R    995bB6  4.1 100- 173     23 275  52S 261 257 +1.3 +3.7 +0.3-1.1
      Distance of    995 to Terminator =  4.2 ; to 3km sunlit peak =  0.4
         995 =  4.3 &  6.0, Sepn 0.200, PA 139: &  8.6, Sepn %112.500, PA 329
23 21 48 20 r  79288 G0  7.8  98- 163     46 113  56N 318 309 +3.8 +2.3 +1.5-0.9
23 22 52 58 R   1113aM0  5.1  98- 162     55 132  63N 311 302 +3.7 +2.2 +1.6-0.9
        1113 =  5.2 & 12.2, Sepn 14.1, PA 196
23 23 12 32 R X54012     5.2  98- 162     57 138  62N 311 302 +3.7 +2.2 +1.6-1.1
24  0 28 07 R  79376pA5  6.9  97- 162     62 171  34N 340 330 +3.6 +2.1 +1.4-4.7
      Distance of  79376 to Terminator = 15.4 ; to 3km sunlit peak =  6.0
       79376 =  7.2 &  8.3, Sepn  6.4, PA  44
24  1 32 53 R   1127vF2  5.9  97- 161     61 203  89N 285 275 +3.5 +2.1 +1.5-0.9
        1127 =  6.7 &  6.7, Sepn 0.100, PA  90
25  3 27 41 r  97918 K1  7.4  92- 146     54 223  90S 285 269 +5.2 +0.3 +1.3-1.2
26  1 39 44 r   1407 K0  7.7  84- 133     55 152  78N 299 280 +6.8 -1.4 +1.4-0.6
26  4 57 37 r  98676 F2  8.0  84- 132     48 230  85N 293 273 +6.4 -1.4 +1.1-1.5
Graze of 139144 F0  nearby at Lat = +47.11 -0.62(E.Long   -7.90), CA =  6.9S
30  6 06 30 Gr139144 F0  8.4  43-  82 -11 40 182
Closest distance to graze path is   73km at azimuth 222
30  6 15 39 r 139144 F0  8.4  43-  82 -10 39 185  21S 224 201 +7.3 -5.8 +4.9+4.5
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Streifende Sternbedeckungen durch den Mond 1999

in der Nähe von Freiburg

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        Grazing Occultation near Freiburg calculated with OCCULT 4.06

              Grazing Occultation of   1487   B7       Mag  1.4
                       Tuesday     1999 February 2

                       Nominal Site Altitude  280 m
    Closest distance to graze path is 310km at azimuth 208

 Longitude    Latitude      UT        Alt   Az  TanZ    PA     WA     CA
   o  ' ''     o  ' ''    h  m  s    Sn Mn   o           o      o      o
+  5 00 00  +45 51 46    0 54 21       56 177  0.67   22.0    0.15  -2.15N
+  5 30 00  +45 41 44    0 55 15       56 178  0.67   22.1    0.25  -2.25N
+  6 00 00  +45 31 31    0 56 10       56 180  0.66   22.2    0.34  -2.34N
+  6 30 00  +45 21 07    0 57 05       57 181  0.66   22.3    0.44  -2.44N
+  7 00 00  +45 10 34    0 58 00       57 182  0.65   22.4    0.53  -2.53N
+  7 30 00  +44 59 49    0 58 56       57 184  0.65   22.5    0.62  -2.63N
+  8 00 00  +44 48 55    0 59 53       57 185  0.65   22.6    0.72  -2.72N
+  8 30 00  +44 37 50    1 00 51       57 186  0.64   22.7    0.81  -2.81N
+  9 00 00  +44 26 34    1 01 48       57 188  0.64   22.8    0.90  -2.90N
+  9 30 00  +44 15 08    1 02 47       57 189  0.64   22.9    0.99  -2.99N
```

+ 10 00 00	+44 03 31	1 03 46	58	190	0.63	23.0	1.08	-3.08N				

1487 is a Double Star: 1.3 & 7.6, Sepn %177.80, PA 307
Graze Path of Secondary 94.33km S, and %453.4 secs. earlier cf. primary.

Librations Long +5.22 Lat -0.40 P 1.0 D +0.8
Illumination of moon 98%-
Elongation of Moon 163°
Vertical Profile Scale 2.20 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.41 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-7.1	2.2	3.6	4.4	4.9	5.2	5.4	5.6
-5.1	2.2	3.6	4.4	4.9	5.2	5.4	5.6
-3.1	2.2	3.6	4.4	4.9	5.2	5.4	5.6
-1.1	2.2	3.6	4.4	4.9	5.2	5.4	5.6
0.9	2.2	3.6	4.4	4.9	5.2	5.4	5.6

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Grazing Occultation near Freiburg
Grazing Occultation of 139299aF8 Mag 7.8
Saturday 1999 February 6

Nominal Site Altitude 280 m
Closest distance to graze path is 85km at azimuth 29

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+49 52 55	1 21 19	26	135	2.07	205.9	183.39	5.93S
+ 5 30 00	+49 42 53	1 21 50	26	136	2.03	206.0	183.48	6.02S
+ 6 00 00	+49 32 43	1 22 22	27	136	2.00	206.1	183.56	6.10S
+ 6 30 00	+49 22 24	1 22 54	27	137	1.96	206.2	183.65	6.19S
+ 7 00 00	+49 11 56	1 23 27	27	137	1.93	206.2	183.73	6.27S
+ 7 30 00	+49 01 19	1 24 01	28	138	1.89	206.3	183.82	6.36S
+ 8 00 00	+48 50 33	1 24 35	28	139	1.86	206.4	183.91	6.45S
+ 8 30 00	+48 39 39	1 25 10	29	139	1.83	206.5	183.99	6.53S
+ 9 00 00	+48 28 35	1 25 46	29	140	1.80	206.6	184.08	6.62S
+ 9 30 00	+48 17 21	1 26 23	30	140	1.77	206.7	184.17	6.71S
+ 10 00 00	+48 05 59	1 27 00	30	141	1.74	206.8	184.27	6.80S

139299 is a Double Star: 8.2 & 13.8, Sepn 2.70, PA 89
Graze Path of Secondary 2.85km S, and 6.3 secs. later cf. primary.

C A S S I N I R E G I O N G R A Z E

Librations Long +3.18 Lat -5.25 P 184.0 D -5.2
Illumination of moon 72%-
Elongation of Moon 116°
Vertical Profile Scale 2.37 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.46 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
2.8	4.6	6.0	6.7	7.2	7.5	7.7	7.8
4.8	4.6	6.1	6.8	7.3	7.6	7.8	7.9
6.8	5.4	6.8	7.6	8.1	8.4	8.6	8.7
8.8	5.4	6.8	7.6	8.1	8.4	8.6	8.8
10.8	5.4	6.9	7.6	8.1	8.4	8.6	8.8

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Grazing Occultation near Freiburg
Grazing Occultation of X32772 F0 Mag 9.1
Friday 1999 February 19

Nominal Site Altitude 280 m
Closest distance to graze path is 73km at azimuth 345

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 07 05	17 53 43	-8 28	236	1.85	156.2	179.96	5.98S
+ 5 30 00	+48 13 14	17 54 10	-9 28	236	1.88	156.3	180.03	5.90S
+ 6 00 00	+48 19 17	17 54 36	-9 28	237	1.91	156.4	180.11	5.82S
+ 6 30 00	+48 25 13	17 55 02	-10 27	238	1.94	156.5	180.19	5.74S
+ 7 00 00	+48 31 02	17 55 28	-10 27	238	1.98	156.6	180.27	5.66S
+ 7 30 00	+48 36 44	17 55 53	-10 26	239	2.01	156.6	180.34	5.59S
+ 8 00 00	+48 42 19	17 56 17	-11 26	239	2.05	156.7	180.42	5.51S
+ 8 30 00	+48 47 47	17 56 41	-11 26	240	2.08	156.8	180.49	5.44S
+ 9 00 00	+48 53 09	17 57 05	-12 25	240	2.12	156.9	180.57	5.36S
+ 9 30 00	+48 58 24	17 57 28	-12 25	241	2.15	156.9	180.64	5.29S
+ 10 00 00	+49 03 33	17 57 51	25	241	2.19	157.0	180.72	5.21S

X32772 is a Double Star: 8.6 & 6.2, Sepn 16.00, PA 74
Graze Path of Secondary 4.45km N, and 31.9 secs. later cf. primary.

Librations Long -2.75 Lat +5.98 P 180.4 D +6.3
Illumination of moon 14%+
Elongation of Moon 45°
Vertical Profile Scale 2.19 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.76 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
1.2	5.3	6.7	7.5	8.0	8.3	8.6	8.8
3.2	5.3	6.8	7.5	8.0	8.4	8.6	8.8
5.2	6.2	7.7	8.5	9.1	9.4	9.7	10.0
7.2	6.3	7.7	8.6	9.1	9.5	9.8	10.0
9.2	6.3	7.8	8.6	9.2	9.6	9.9	10.1

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Grazing Occultation near Freiburg
Grazing Occultation of 150aF1 Mag 6.1
Friday 1999 February 19

Nominal Site Altitude 280 m
Closest distance to graze path is 79km at azimuth 345

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 10 02	17 54 13	-8 28	236	1.86	156.3	179.97	5.96S
+ 5 30 00	+48 16 10	17 54 40	-9 28	237	1.89	156.3	180.05	5.88S
+ 6 00 00	+48 22 11	17 55 06	-9 28	237	1.92	156.4	180.13	5.80S
+ 6 30 00	+48 28 06	17 55 32	-10 27	238	1.95	156.5	180.21	5.72S
+ 7 00 00	+48 33 53	17 55 57	-10 27	238	1.98	156.6	180.28	5.65S
+ 7 30 00	+48 39 33	17 56 22	-10 26	239	2.02	156.7	180.36	5.57S
+ 8 00 00	+48 45 07	17 56 47	-11 26	239	2.05	156.7	180.44	5.49S
+ 8 30 00	+48 50 34	17 57 11	-11 26	240	2.09	156.8	180.51	5.42S
+ 9 00 00	+48 55 54	17 57 34	-12 25	240	2.13	156.9	180.59	5.35S
+ 9 30 00	+49 01 08	17 57 57	25	241	2.16	157.0	180.66	5.27S
+ 10 00 00	+49 06 15	17 58 20	24	241	2.20	157.0	180.73	5.20S

150 is a Double Star: 6.2 & 8.6, Sepn 16.00, PA 253
Graze Path of Secondary 3.80km S, and 32.0 secs. earlier cf. primary.

Librations Long -2.75 Lat +5.98 P 180.4 D +6.3
Illumination of moon 14%+
Elongation of Moon 45°
Vertical Profile Scale 2.19 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.76 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
1.2	5.3	6.7	7.5	8.0	8.3	8.6	8.8
3.2	5.3	6.8	7.5	8.0	8.4	8.6	8.8
5.2	6.2	7.7	8.5	9.1	9.4	9.7	9.9
7.2	6.3	7.7	8.6	9.1	9.5	9.8	10.0
9.2	6.3	7.8	8.6	9.2	9.6	9.9	10.1

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Grazing Occultation near Freiburg
Grazing Occultation of 93186 F0 Mag 7.8
Sunday 1999 February 21

Nominal Site Altitude 280 m
Closest distance to graze path is 44km at azimuth 350

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 00 00	18 36 58	44	226	1.03	160.7	177.88	4.39S
+ 5 30 00	+48 04 26	18 37 39	44	227	1.05	160.8	177.97	4.30S
+ 6 00 00	+48 08 44	18 38 19	43	228	1.06	160.9	178.06	4.21S
+ 6 30 00	+48 12 54	18 38 59	43	228	1.08	161.0	178.15	4.12S
+ 7 00 00	+48 16 57	18 39 39	43	229	1.09	161.1	178.24	4.04S
+ 7 30 00	+48 20 52	18 40 18	42	230	1.10	161.1	178.32	3.95S
+ 8 00 00	+48 24 40	18 40 57	42	230	1.12	161.2	178.41	3.86S
+ 8 30 00	+48 28 20	18 41 35	41	231	1.13	161.3	178.50	3.77S
+ 9 00 00	+48 31 53	18 42 13	41	232	1.15	161.4	178.58	3.69S
+ 9 30 00	+48 35 19	18 42 50	41	232	1.16	161.5	178.67	3.60S
+ 10 00 00	+48 38 38	18 43 27	40	233	1.18	161.6	178.75	3.52S

Librations Long -0.16 Lat +7.25 P 178.7 D +7.5
Illumination of moon 34%+
Elongation of Moon 72°
Vertical Profile Scale 2.15 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.62 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-0.5	3.3	4.7	5.4	5.9	6.2	6.4	6.5
1.5	5.1	6.5	7.3	7.8	8.2	8.4	8.6
3.5	5.1	6.5	7.3	7.8	8.2	8.4	8.6
5.5	5.9	7.4	8.2	8.7	9.1	9.4	9.6
7.5	5.9	7.4	8.2	8.7	9.1	9.4	9.6

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Grazing Occultation near Freiburg
Grazing Occultation of 93633 K0 Mag 8.6
Monday 1999 February 22

Nominal Site Altitude 280 m
Closest distance to graze path is 36km at azimuth 162

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+46 58 16	17 34 16	-4 57	186	0.65	161.9	174.30	6.23S
+ 5 30 00	+47 05 44	17 35 12	-5 57	187	0.66	162.0	174.40	6.14S
+ 6 00 00	+47 13 04	17 36 08	-5 57	188	0.66	162.1	174.49	6.04S
+ 6 30 00	+47 20 14	17 37 03	-6 56	189	0.67	162.2	174.59	5.95S
+ 7 00 00	+47 27 15	17 37 58	-6 56	191	0.67	162.3	174.68	5.85S
+ 7 30 00	+47 34 06	17 38 52	-7 56	192	0.68	162.4	174.77	5.76S
+ 8 00 00	+47 40 49	17 39 46	-7 56	193	0.68	162.5	174.87	5.67S
+ 8 30 00	+47 47 22	17 40 40	-8 56	194	0.69	162.6	174.96	5.57S
+ 9 00 00	+47 53 47	17 41 33	-8 55	195	0.69	162.7	175.06	5.48S
+ 9 30 00	+48 00 03	17 42 26	-9 55	197	0.70	162.8	175.15	5.38S
+ 10 00 00	+48 06 09	17 43 19	-9 55	198	0.71	162.8	175.24	5.29S

Librations Long +1.25 Lat +7.28 P 175.4 D +7.6
Illumination of moon 46%+
Elongation of Moon 85°
Vertical Profile Scale 2.18 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.50 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
1.3	5.1	6.5	7.3	7.8	8.2	8.5	8.7
3.3	5.1	6.5	7.3	7.8	8.2	8.5	8.7
5.3	5.9	7.4	8.2	8.7	9.1	9.4	9.6
7.3	5.9	7.4	8.2	8.7	9.1	9.4	9.6
9.3	5.9	7.4	8.2	8.7	9.1	9.4	9.6

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Grazing Occultation near Freiburg
Grazing Occultation of 1644 B9 Mag 4.1
Tuesday 1999 March 2

Nominal Site Altitude 280 m
Closest distance to graze path is 342km at azimuth 181

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+44 55 03	19 23 24	15	97	3.64	198.1	173.90	10.73S
+ 5 30 00	+44 55 17	19 23 39	16	97	3.54	198.2	173.97	10.80S
+ 6 00 00	+44 55 27	19 23 54	16	98	3.45	198.3	174.03	10.87S
+ 6 30 00	+44 55 31	19 24 10	17	98	3.36	198.3	174.10	10.93S
+ 7 00 00	+44 55 29	19 24 26	17	98	3.28	198.4	174.17	11.00S
+ 7 30 00	+44 55 23	19 24 43	17	99	3.20	198.5	174.24	11.07S
+ 8 00 00	+44 55 12	19 25 00	18	99	3.12	198.6	174.31	11.14S
+ 8 30 00	+44 54 55	19 25 18	18	100	3.05	198.6	174.38	11.21S
+ 9 00 00	+44 54 32	19 25 36	19	100	2.98	198.7	174.45	11.28S
+ 9 30 00	+44 54 05	19 25 54	19	101	2.91	198.8	174.52	11.35S
+ 10 00 00	+44 53 32	19 26 13	19	101	2.85	198.8	174.59	11.43S

C A S S I N I R E G I O N G R A Z E

Librations Long +5.01 Lat -2.66 P 174.4 D -1.9
Illumination of moon 100%-
Elongation of Moon 173°
Vertical Profile Scale 2.06 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.75 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
7.4	1.8	3.2	3.8	4.2	4.4	4.5	4.6
9.4	1.8	3.2	3.8	4.2	4.4	4.5	4.6
11.4	1.8	3.2	3.8	4.2	4.4	4.5	4.6
13.4	1.8	3.2	3.8	4.2	4.4	4.5	4.6
15.4	1.8	3.2	3.8	4.2	4.4	4.5	4.6

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Grazing Occultation near Freiburg
Grazing Occultation of 508vK0 Mag 4.1
Sunday 1999 March 21

Nominal Site Altitude 280 m
Closest distance to graze path is 302km at azimuth 163

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+44 27 57	15 51 34	20 58	196	0.63	160.5	174.65	9.70S
+ 5 30 00	+44 35 30	15 52 31	20 57	198	0.64	160.6	174.75	9.60S
+ 6 00 00	+44 42 52	15 53 27	19 57	199	0.65	160.7	174.85	9.50S
+ 6 30 00	+44 50 05	15 54 23	19 57	200	0.66	160.8	174.95	9.40S

+ 7 00 00	+44 57 08	15 55 18	18 56 201	0.66	160.9	175.05	9.30S
+ 7 30 00	+45 04 02	15 56 13	18 56 203	0.67	161.0	175.16	9.20S
+ 8 00 00	+45 10 46	15 57 08	17 56 204	0.68	161.1	175.26	9.10S
+ 8 30 00	+45 17 21	15 58 01	17 56 205	0.69	161.2	175.35	9.00S
+ 9 00 00	+45 23 47	15 58 55	16 55 206	0.69	161.3	175.45	8.90S
+ 9 30 00	+45 30 03	15 59 48	16 55 207	0.70	161.4	175.55	8.80S
+ 10 00 00	+45 36 10	16 00 40	15 55 208	0.71	161.5	175.65	8.70S

508 is a Double Star: 4.5 & 6.5, Sepn 0.01

Librations Long +1.49 Lat +7.18 P 175.8 D +7.5
Illumination of moon 20%+
Elongation of Moon 53°
Vertical Profile Scale 2.12 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.52 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
4.7	2.9	4.4	5.1	5.6	5.9	6.1	6.3
6.7	2.9	4.4	5.1	5.6	5.9	6.1	6.3
8.7	2.9	4.4	5.1	5.6	5.9	6.1	6.3
10.7	2.9	4.4	5.1	5.6	5.9	6.1	6.3
12.7	2.9	4.4	5.1	5.6	5.9	6.1	6.3

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Grazing Occultation near Freiburg
Grazing Occultation of 93514 A0 Mag 8.5
Sunday 1999 March 21

Nominal Site Altitude 280 m
Closest distance to graze path is 34km at azimuth 186

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 51 31	19 05 34	32	253	1.58	167.2	180.78	3.32S
+ 5 30 00	+47 50 01	19 06 02	32	254	1.60	167.2	180.84	3.26S
+ 6 00 00	+47 48 26	19 06 30	32	254	1.63	167.3	180.91	3.19S
+ 6 30 00	+47 46 45	19 06 57	31	255	1.65	167.4	180.98	3.12S
+ 7 00 00	+47 44 59	19 07 24	31	255	1.68	167.4	181.04	3.06S
+ 7 30 00	+47 43 07	19 07 51	30	256	1.71	167.5	181.11	2.99S
+ 8 00 00	+47 41 09	19 08 18	30	256	1.73	167.6	181.17	2.93S
+ 8 30 00	+47 39 05	19 08 44	30	257	1.76	167.6	181.24	2.86S
+ 9 00 00	+47 36 57	19 09 09	29	257	1.79	167.7	181.30	2.80S
+ 9 30 00	+47 34 42	19 09 35	29	258	1.82	167.8	181.37	2.73S
+ 10 00 00	+47 32 23	19 10 00	28	258	1.85	167.8	181.43	2.67S

Librations Long +1.27 Lat +7.17 P 181.6 D +7.4
Illumination of moon 21%+
Elongation of Moon 55°
Vertical Profile Scale 2.12 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.81 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-1.3	3.3	4.7	5.4	5.8	6.1	6.3	6.4
0.7	5.1	6.5	7.3	7.8	8.1	8.4	8.6
2.7	5.1	6.5	7.3	7.8	8.1	8.4	8.6
4.7	5.9	7.3	8.1	8.7	9.1	9.3	9.5
6.7	5.9	7.4	8.2	8.7	9.1	9.4	9.6

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Grazing Occultation near Freiburg
Grazing Occultation of 669vG7 Mag 3.8
Monday 1999 March 22

Nominal Site Altitude 280 m
Closest distance to graze path is 228km at azimuth 157

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+44 50 39	14 56 26	29 57	146	0.64	163.2	171.90	10.22S
+ 5 30 00	+45 00 32	14 57 26	29 57	147	0.64	163.3	171.98	10.14S
+ 6 00 00	+45 10 16	14 58 25	28 58	149	0.64	163.4	172.06	10.06S
+ 6 30 00	+45 19 51	14 59 25	28 58	150	0.63	163.4	172.14	9.98S
+ 7 00 00	+45 29 17	15 00 24	27 58	151	0.63	163.5	172.22	9.90S
+ 7 30 00	+45 38 34	15 01 23	27 58	153	0.63	163.6	172.30	9.82S
+ 8 00 00	+45 47 42	15 02 21	26 58	154	0.62	163.7	172.38	9.74S
+ 8 30 00	+45 56 40	15 03 20	26 58	155	0.62	163.8	172.46	9.66S
+ 9 00 00	+46 05 29	15 04 18	25 58	157	0.62	163.9	172.55	9.57S
+ 9 30 00	+46 14 09	15 05 17	24 58	158	0.62	163.9	172.63	9.49S
+ 10 00 00	+46 22 40	15 06 15	24 58	160	0.62	164.0	172.71	9.41S

669 is a Double Star: 4.0 & 7.8, Sepn 0.08, PA 212
Graze Path of Secondary 0.13km N, and 0.1 secs. earlier cf. primary.

Librations Long +3.20 Lat +6.94 P 173.1 D +7.5
Illumination of moon 30%+
Elongation of Moon 66°
Vertical Profile Scale 2.18 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.51 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
5.4	3.1	4.6	5.3	5.8	6.1	6.4	6.5
7.4	3.1	4.6	5.3	5.8	6.1	6.4	6.5
9.4	3.1	4.6	5.3	5.8	6.1	6.4	6.5
11.4	3.1	4.6	5.3	5.8	6.1	6.4	6.5
13.4	3.1	4.6	5.3	5.8	6.1	6.4	6.5

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Grazing Occultation near Freiburg
Grazing Occultation of 94678kK5 Mag 7.6
Tuesday 1999 March 23

Nominal Site Altitude 280 m
Closest distance to graze path is 15km at azimuth 10

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 26 20	19 17 49	51	232	0.81	356.8	358.53	-1.54N
+ 5 30 00	+48 23 29	19 18 29	51	233	0.82	356.8	358.61	-1.46N
+ 6 00 00	+48 20 32	19 19 08	50	234	0.83	356.9	358.69	-1.38N
+ 6 30 00	+48 17 28	19 19 48	50	234	0.84	357.0	358.78	-1.29N
+ 7 00 00	+48 14 16	19 20 27	50	235	0.85	357.1	358.85	-1.22N
+ 7 30 00	+48 10 58	19 21 05	49	236	0.86	357.2	358.93	-1.14N
+ 8 00 00	+48 07 33	19 21 44	49	237	0.87	357.2	359.01	-1.06N
+ 8 30 00	+48 04 01	19 22 23	49	238	0.88	357.3	359.09	-0.98N
+ 9 00 00	+48 00 22	19 23 01	48	239	0.89	357.4	359.17	-0.90N
+ 9 30 00	+47 56 36	19 23 39	48	239	0.90	357.5	359.25	-0.82N
+ 10 00 00	+47 52 43	19 24 17	48	240	0.91	357.6	359.32	-0.75N

94678 is a Double Star: 7.7 & 8.7, Sepn 0.80, PA 96
Graze Path of Secondary 0.26km N, and 1.8 secs. later cf. primary.

C A S S I N I R E G I O N G R A Z E

Librations Long +4.01 Lat +6.10 P 359.8 D -5.9
Illumination of moon 43%+
Elongation of Moon 82°
Vertical Profile Scale 2.14 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.59 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-4.7	3.2	4.6	5.4	5.8	6.2	6.4	6.5
-2.7	3.2	4.6	5.4	5.8	6.2	6.4	6.5
-0.7	3.2	4.6	5.4	5.8	6.2	6.4	6.5
1.3	5.0	6.5	7.3	7.8	8.2	8.4	8.6
3.3	5.1	6.5	7.3	7.8	8.2	8.4	8.6

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Grazing Occultation near Freiburg
Grazing Occultation of 97757vA3 Mag 8.2
Thursday 1999 April 22

Nominal Site Altitude 280 m
Closest distance to graze path is 73km at azimuth 36

	Longitude			Latitude			UT			Alt	Az	TanZ	PA	WA	CA
	o	'	''	o	'	''	h	m	s	Sn Mn	o		o	o	o
+	5	00	00	+50	09	47	22	11	43	31	261	1.69	14.7	0.08	1.42N
+	5	30	00	+49	55	48	22	12	21	30	262	1.72	14.7	0.10	1.44N
+	6	00	00	+49	41	47	22	12	58	30	262	1.74	14.7	0.11	1.45N
+	6	30	00	+49	27	44	22	13	36	29	263	1.77	14.7	0.12	1.46N
+	7	00	00	+49	13	39	22	14	12	29	264	1.80	14.8	0.13	1.47N
+	7	30	00	+48	59	32	22	14	49	29	264	1.83	14.8	0.14	1.48N
+	8	00	00	+48	45	24	22	15	25	28	265	1.86	14.8	0.15	1.49N
+	8	30	00	+48	31	15	22	16	01	28	265	1.89	14.8	0.15	1.49N
+	9	00	00	+48	17	05	22	16	36	27	266	1.93	14.8	0.16	1.50N
+	9	30	00	+48	02	55	22	17	11	27	267	1.96	14.8	0.16	1.50N
+	10	00	00	+47	48	44	22	17	46	27	267	2.00	14.8	0.17	1.51N

97757 is a Double Star: 9.0 & 9.0, Sepn 0.05

C A S S I N I R E G I O N G R A Z E

Librations Long +6.47 Lat +2.45 P 0.4 D -2.2
Illumination of moon 51%+
Elongation of Moon 91°
Vertical Profile Scale 2.68 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.86 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-2.5	2.9	4.3	5.0	5.4	5.7	5.9	6.0
-0.5	2.9	4.3	5.0	5.4	5.7	5.9	6.0
1.5	4.7	6.1	6.9	7.3	7.6	7.8	8.0
3.5	4.7	6.1	6.9	7.3	7.6	7.8	8.0
5.5	5.5	6.9	7.7	8.2	8.5	8.7	8.9

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Grazing Occultation near Freiburg
Grazing Occultation of 1371oG9 Mag 6.5
Friday 1999 April 23

Nominal Site Altitude 280 m
Closest distance to graze path is 53km at azimuth 210

	Longitude			Latitude			UT			Alt	Az	TanZ	PA	WA	CA
	o	'	''	o	'	''	h	m	s	Sn Mn	o		o	o	o
+	5	00	00	+48	32	13	19	58	47	53	210	0.74	198.8	180.23	-1.72S
+	5	30	00	+48	21	21	19	59	46	53	212	0.75	198.8	180.30	-1.79S
+	6	00	00	+48	10	20	20	00	46	53	213	0.75	198.9	180.37	-1.86S
+	6	30	00	+47	59	10	20	01	47	53	214	0.75	199.0	180.44	-1.94S
+	7	00	00	+47	47	50	20	02	47	53	215	0.76	199.1	180.51	-2.01S
+	7	30	00	+47	36	21	20	03	48	53	217	0.76	199.1	180.58	-2.08S

+ 8 00 00	+47 24 43	20 04 48	53	218	0.76	199.2	180.65	-2.14S
+ 8 30 00	+47 12 55	20 05 50	52	219	0.77	199.3	180.72	-2.21S
+ 9 00 00	+47 00 59	20 06 51	52	220	0.77	199.3	180.78	-2.28S
+ 9 30 00	+46 48 53	20 07 52	52	221	0.78	199.4	180.85	-2.34S
+ 10 00 00	+46 36 39	20 08 54	52	223	0.78	199.4	180.91	-2.40S

1371 is a Double Star: 7.2 & 7.2, Sepn 0.20, PA 210
Graze Path of Secondary 0.45km N, and 0.1 secs. earlier cf. primary.

Librations Long +6.81 Lat +0.92 P 181.0 D +1.1
Illumination of moon 61%+
Elongation of Moon 103°
Vertical Profile Scale 2.30 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.48 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-6.4	3.0	4.4	5.2	5.7	6.0	6.2	6.4
-4.4	3.0	4.4	5.2	5.7	6.0	6.2	6.4
-2.4	3.0	4.4	5.2	5.7	6.0	6.2	6.4
-0.4	3.0	4.4	5.2	5.7	6.0	6.2	6.4
1.6	4.9	6.3	7.1	7.6	8.0	8.2	8.4

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Grazing Occultation near Freiburg
Grazing Occultation of 3275 K0 Mag 6.0
Sunday 1999 June 6

Nominal Site Altitude 280 m
Closest distance to graze path is 13km at azimuth 345

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 43 09	2 04 49	17	134	3.20	162.8	185.63	3.36S
+ 5 30 00	+47 46 31	2 05 26	18	135	3.14	162.7	185.53	3.26S
+ 6 00 00	+47 50 12	2 06 03	-12 18	136	3.09	162.6	185.44	3.17S
+ 6 30 00	+47 54 12	2 06 42	-12 18	136	3.05	162.5	185.35	3.07S
+ 7 00 00	+47 58 32	2 07 21	-11 18	137	3.00	162.4	185.25	2.98S
+ 7 30 00	+48 03 11	2 08 01	-11 19	137	2.96	162.4	185.16	2.88S
+ 8 00 00	+48 08 10	2 08 41	-11 19	138	2.92	162.3	185.06	2.79S
+ 8 30 00	+48 13 30	2 09 22	-10 19	139	2.88	162.2	184.97	2.69S
+ 9 00 00	+48 19 10	2 10 05	-10 19	139	2.85	162.1	184.87	2.60S
+ 9 30 00	+48 25 11	2 10 47	-10 20	140	2.81	162.0	184.77	2.50S
+ 10 00 00	+48 31 32	2 11 31	-9 20	141	2.78	161.9	184.68	2.41S

Librations Long -7.36 Lat +2.80 P 184.3 D +3.6
Illumination of moon 61%-
Elongation of Moon 103°
Vertical Profile Scale 4.94 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.99 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-1.6	2.7	4.1	4.7	5.1	5.3	5.4	5.5
0.4	2.7	4.1	4.7	5.1	5.3	5.4	5.5
2.4	4.4	5.8	6.5	6.9	7.2	7.4	7.5
4.4	4.6	6.0	6.7	7.1	7.4	7.5	7.7
6.4	5.2	6.6	7.3	7.8	8.0	8.2	8.4

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Grazing Occultation near Freiburg
Grazing Occultation of 669vG7 Mag 3.8
Saturday 1999 July 10

Nominal Site Altitude 280 m

Closest distance to graze path is 159km at azimuth 324

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 23 20	5 02 48	10 32	103	1.57	162.7	171.22	-1.80S
+ 5 30 00	+48 37 51	5 03 29	10 33	104	1.55	162.7	171.23	-1.79S
+ 6 00 00	+48 52 21	5 04 10	11 33	104	1.53	162.7	171.24	-1.78S
+ 6 30 00	+49 06 48	5 04 51	11 34	105	1.51	162.7	171.25	-1.77S
+ 7 00 00	+49 21 14	5 05 33	12 34	106	1.49	162.7	171.26	-1.75S
+ 7 30 00	+49 35 37	5 06 15	12 34	107	1.47	162.7	171.27	-1.74S
+ 8 00 00	+49 49 57	5 06 57	13 35	107	1.45	162.7	171.29	-1.73S
+ 8 30 00	+50 04 14	5 07 40	13 35	108	1.43	162.8	171.30	-1.71S
+ 9 00 00	+50 18 27	5 08 23	14 35	109	1.41	162.8	171.31	-1.70S
+ 9 30 00	+50 32 37	5 09 06	14 36	110	1.40	162.8	171.33	-1.69S
+ 10 00 00	+50 46 43	5 09 49	15 36	110	1.38	162.8	171.35	-1.67S

669 is a Double Star: 4.0 & 7.8, Sepn 0.08, PA 212
Graze Path of Secondary 0.15km N, and 0.1 secs. earlier cf. primary.

Librations Long -0.74 Lat +6.88 P 171.3 D +7.0
Illumination of moon 12%-
Elongation of Moon 40°
Vertical Profile Scale 2.67 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.83 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-5.7	1.5	2.9	3.6	4.1	4.3	4.5	4.7
-3.7	1.5	2.9	3.6	4.1	4.3	4.5	4.7
-1.7	1.5	2.9	3.6	4.1	4.3	4.5	4.7
0.3	2.2	3.6	4.3	4.8	5.1	5.3	5.4
2.3	2.2	3.6	4.3	4.8	5.1	5.3	5.4

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Grazing Occultation near Freiburg
Grazing Occultation of 692 K5 Mag 0.9
Saturday 1999 July 10

Nominal Site Altitude 280 m
Closest distance to graze path is 37km at azimuth 343

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 42 52	8 50 12	47 59	173	0.61	164.8	172.61	-0.30S
+ 5 30 00	+47 49 44	8 51 06	47 59	175	0.61	164.9	172.70	-0.22S
+ 6 00 00	+47 56 27	8 51 59	48 59	176	0.61	165.0	172.79	-0.13S
+ 6 30 00	+48 03 01	8 52 52	48 58	177	0.61	165.1	172.88	-0.04S
+ 7 00 00	+48 09 26	8 53 45	48 58	179	0.62	165.2	172.97	0.05S
+ 7 30 00	+48 15 42	8 54 38	49 58	180	0.62	165.3	173.06	0.14S
+ 8 00 00	+48 21 49	8 55 31	49 58	181	0.62	165.3	173.15	0.23S
+ 8 30 00	+48 27 48	8 56 23	50 58	183	0.62	165.4	173.24	0.32S
+ 9 00 00	+48 33 38	8 57 15	50 58	184	0.63	165.5	173.33	0.42S
+ 9 30 00	+48 39 19	8 58 06	50 58	185	0.63	165.6	173.42	0.51S
+ 10 00 00	+48 44 51	8 58 58	51 58	187	0.63	165.7	173.51	0.60S

692 is a Double Star: 1.1 & 11.3, Sepn %132.40, PA 32
Graze Path of Secondary 210.85km S, and %214.5 secs. later cf. primary.

- with a Tertiary Star: 13.6, Sepn 30.80, PA 110
Graze Path of Tertiary 40.00km S, and 57.0 secs. earlier cf. primary.

692 = Alpha TAU, 0.75 +/- 0.95V, Var Type LB:

Librations Long -0.99 Lat +6.58 P 173.4 D +6.7
Illumination of moon 11%-
Elongation of Moon 38°
Vertical Profile Scale 2.17 km/arcsec at mean distance of moon

Horizontal Scale Factor 1.55 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-3.4	1.8	3.2	3.9	4.4	4.8	5.0	5.1
-1.4	1.8	3.2	3.9	4.4	4.8	5.0	5.1
0.6	2.5	3.9	4.7	5.2	5.5	5.7	5.9
2.6	2.5	3.9	4.7	5.2	5.5	5.7	5.9
4.6	2.8	4.2	5.0	5.5	5.8	6.0	6.2

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Grazing Occultation near Freiburg
Grazing Occultation of 128661 M0 Mag 6.6
Sunday 1999 August 29

Nominal Site Altitude 280 m
Closest distance to graze path is 77km at azimuth 337

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 53 59	4 14 28	-7 27	229	1.93	333.8	358.43	11.62N
+ 5 30 00	+48 03 06	4 14 51	-7 27	229	1.96	333.9	358.51	11.54N
+ 6 00 00	+48 12 05	4 15 13	-6 27	230	1.99	333.9	358.59	11.46N
+ 6 30 00	+48 20 55	4 15 35	-6 26	230	2.03	334.0	358.67	11.38N
+ 7 00 00	+48 29 38	4 15 56	-5 26	231	2.06	334.1	358.75	11.31N
+ 7 30 00	+48 38 14	4 16 17	-5 25	231	2.10	334.2	358.83	11.23N
+ 8 00 00	+48 46 42	4 16 37	-5 25	232	2.14	334.3	358.91	11.15N
+ 8 30 00	+48 55 02	4 16 57	-4 25	232	2.18	334.3	358.98	11.07N
+ 9 00 00	+49 03 15	4 17 16	-4 24	233	2.22	334.4	359.06	11.00N
+ 9 30 00	+49 11 20	4 17 35	-3 24	233	2.26	334.5	359.14	10.92N
+ 10 00 00	+49 19 18	4 17 53	-3 24	234	2.30	334.6	359.21	10.85N

C A S S I N I R E G I O N G R A Z E

Librations Long -4.91 Lat +5.71 P 358.7 D -5.4
Illumination of moon 94%-
Elongation of Moon 153°
Vertical Profile Scale 2.26 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.71 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
6.8	2.9	4.2	4.9	5.3	5.6	5.7	5.8
8.8	3.9	5.3	6.0	6.4	6.7	6.8	6.9
10.8	4.1	5.5	6.2	6.6	6.8	7.0	7.1
12.8	4.2	5.6	6.3	6.7	7.0	7.1	7.3
14.8	4.4	5.8	6.5	6.9	7.2	7.4	7.5

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Grazing Occultation near Freiburg
Grazing Occultation of 913lB8 Mag 5.1
Saturday 1999 September 4

Nominal Site Altitude 280 m
Closest distance to graze path is 102km at azimuth 202

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 46 02	10 25 22	47 39	256	1.25	1.3	359.97	-2.34N
+ 5 30 00	+47 38 30	10 25 55	47 38	257	1.27	1.3	0.03	-2.40N
+ 6 00 00	+47 30 51	10 26 28	47 38	258	1.29	1.4	0.08	-2.45N
+ 6 30 00	+47 23 06	10 27 00	48 37	258	1.30	1.4	0.14	-2.51N
+ 7 00 00	+47 15 15	10 27 33	48 37	259	1.32	1.5	0.19	-2.56N
+ 7 30 00	+47 07 18	10 28 05	48 37	259	1.34	1.6	0.25	-2.62N
+ 8 00 00	+46 59 15	10 28 37	48 36	260	1.36	1.6	0.30	-2.67N
+ 8 30 00	+46 51 06	10 29 09	49 36	261	1.38	1.7	0.35	-2.72N

+ 9 00 00	+46 42 51	10 29 40	49 35	261	1.40	1.7	0.40	-2.77N
+ 9 30 00	+46 34 31	10 30 11	49 35	262	1.42	1.8	0.45	-2.82N
+ 10 00 00	+46 26 04	10 30 42	50 35	262	1.45	1.8	0.50	-2.87N

913 is a Double Star: 6.3 & 6.3, Sepn 0.00

- with a Tertiary Star: 6.5, Sepn 0.06, PA 76
Graze Path of Tertiary 0.04km S, and 0.1 secs. later cf. primary.

C A S S I N I R E G I O N G R A Z E

Librations Long +1.37 Lat +5.01 P 0.6 D -4.7
Illumination of moon 33%-
Elongation of Moon 71°
Vertical Profile Scale 2.19 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.77 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-6.9	2.0	3.4	4.1	4.5	4.8	5.0	5.1
-4.9	2.0	3.4	4.1	4.5	4.8	5.0	5.1
-2.9	2.0	3.4	4.1	4.5	4.8	5.0	5.1
-0.9	2.0	3.4	4.1	4.5	4.8	5.0	5.1
1.1	2.8	4.2	4.9	5.3	5.6	5.8	5.9

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Grazing Occultation near Freiburg
Grazing Occultation of 508vK0 Mag 4.1
Wednesday 1999 September 29

Nominal Site Altitude 280 m
Closest distance to graze path is 42km at azimuth 144

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+46 03 01	0 14 59	45	125	1.01	157.4	171.31	-13.57S
+ 5 30 00	+46 18 31	0 15 56	45	126	1.00	157.5	171.34	-13.54S
+ 6 00 00	+46 33 57	0 16 53	45	127	0.99	157.5	171.37	-13.51S
+ 6 30 00	+46 49 16	0 17 50	46	128	0.98	157.5	171.40	-13.48S
+ 7 00 00	+47 04 29	0 18 47	46	129	0.97	157.5	171.43	-13.45S
+ 7 30 00	+47 19 36	0 19 44	46	130	0.97	157.6	171.47	-13.41S
+ 8 00 00	+47 34 36	0 20 41	46	131	0.96	157.6	171.50	-13.37S
+ 8 30 00	+47 49 30	0 21 38	46	132	0.95	157.7	171.54	-13.34S
+ 9 00 00	+48 04 16	0 22 35	47	133	0.95	157.7	171.58	-13.30S
+ 9 30 00	+48 18 55	0 23 31	47	134	0.94	157.7	171.62	-13.26S
+ 10 00 00	+48 33 26	0 24 28	47	136	0.93	157.8	171.66	-13.22S

508 is a Double Star: 4.5 & 6.5, Sepn 0.01

Librations Long +0.21 Lat +7.14 P 171.7 D +7.4
Illumination of moon 83%-
Elongation of Moon 132°
Vertical Profile Scale 2.48 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.64 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-17.2	2.6	4.1	4.8	5.3	5.6	5.8	6.0
-15.2	2.6	4.1	4.8	5.3	5.6	5.8	6.0
-13.2	2.6	4.1	4.8	5.3	5.6	5.8	6.0
-11.2	2.6	4.1	4.8	5.3	5.6	5.8	6.0
-9.2	2.6	4.1	4.8	5.3	5.6	5.8	6.0

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Grazing Occultation near Freiburg

Grazing Occultation of 516kG5 Mag 6.9
Wednesday 1999 September 29

Nominal Site Altitude 280 m
Closest distance to graze path is 89km at azimuth 154

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+46 04 15	2 10 19	57	165	0.65	338.1	351.73	12.89N
+ 5 30 00	+46 15 25	2 11 12	57	166	0.65	338.2	351.81	12.81N
+ 6 00 00	+46 26 25	2 12 05	57	168	0.65	338.3	351.90	12.73N
+ 6 30 00	+46 37 14	2 12 57	57	169	0.65	338.4	351.98	12.65N
+ 7 00 00	+46 47 54	2 13 48	57	170	0.66	338.5	352.07	12.56N
+ 7 30 00	+46 58 23	2 14 40	57	172	0.66	338.5	352.15	12.48N
+ 8 00 00	+47 08 42	2 15 30	57	173	0.66	338.6	352.23	12.39N
+ 8 30 00	+47 18 51	2 16 21	56	174	0.66	338.7	352.32	12.31N
+ 9 00 00	+47 28 50	2 17 11	56	175	0.67	338.8	352.41	12.22N
+ 9 30 00	+47 38 39	2 18 00	56	177	0.67	338.9	352.49	12.13N
+ 10 00 00	+47 48 18	2 18 49	56	178	0.67	339.0	352.58	12.05N

516 is a Double Star: 8.1 & 8.1, Sepn 0.10, PA 90
Graze Path of Secondary 0.08km N, and 0.2 secs. later cf. primary.

Librations Long +0.03 Lat +7.00 P 352.6 D -6.7
Illumination of moon 83%-
Elongation of Moon 131°
Vertical Profile Scale 2.22 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.53 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
8.0	5.2	6.6	7.4	7.9	8.3	8.6	8.8
10.0	5.6	7.0	7.8	8.4	8.7	9.0	9.2
12.0	5.6	7.1	7.9	8.4	8.7	9.0	9.2
14.0	5.6	7.1	7.9	8.4	8.7	9.0	9.2
16.0	5.6	7.1	7.9	8.4	8.8	9.0	9.2

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Grazing Occultation near Freiburg
Grazing Occultation of 832 M2 Mag 4.3
Friday 1999 October 1

Nominal Site Altitude 280 m
Closest distance to graze path is 328km at azimuth 331

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+50 20 05	1 34 08	42	115	1.10	167.8	169.78	-10.47S
+ 5 30 00	+50 31 01	1 34 52	43	115	1.09	167.9	169.83	-10.43S
+ 6 00 00	+50 41 50	1 35 37	43	116	1.08	167.9	169.88	-10.38S
+ 6 30 00	+50 52 32	1 36 22	43	117	1.07	168.0	169.92	-10.34S
+ 7 00 00	+51 03 07	1 37 06	43	118	1.06	168.0	169.97	-10.29S
+ 7 30 00	+51 13 35	1 37 51	44	119	1.05	168.1	170.02	-10.24S
+ 8 00 00	+51 23 55	1 38 36	44	120	1.03	168.1	170.07	-10.19S
+ 8 30 00	+51 34 09	1 39 21	44	121	1.02	168.2	170.12	-10.14S
+ 9 00 00	+51 44 15	1 40 06	45	122	1.01	168.2	170.17	-10.09S
+ 9 30 00	+51 54 13	1 40 51	45	123	1.01	168.3	170.22	-10.04S
+ 10 00 00	+52 04 05	1 41 36	45	123	1.00	168.3	170.27	-9.98S

832 = Ce TAU, 4.23 to 4.54V, Var Type SRC

Librations Long +3.00 Lat +5.53 P 170.6 D +6.2
Illumination of moon 62%-
Elongation of Moon 104°
Vertical Profile Scale 2.39 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.68 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-14.0	2.9	4.4	5.1	5.6	5.9	6.1	6.3
-12.0	2.9	4.4	5.1	5.6	5.9	6.1	6.3
-10.0	2.9	4.4	5.1	5.6	5.9	6.1	6.3
-8.0	2.9	4.4	5.1	5.6	5.9	6.1	6.3
-6.0	2.9	4.4	5.1	5.6	5.9	6.1	6.3

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Grazing Occultation near Freiburg
Grazing Occultation of 1275xK5 Mag 5.3
Monday 1999 October 4

Nominal Site Altitude 280 m
Closest distance to graze path is 8km at azimuth 339

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 17 41	1 57 58	19	84	2.89	3.9	348.42	9.75N
+ 5 30 00	+47 25 56	1 58 15	20	84	2.82	3.9	348.46	9.71N
+ 6 00 00	+47 34 07	1 58 32	20	85	2.76	4.0	348.49	9.67N
+ 6 30 00	+47 42 13	1 58 49	20	85	2.70	4.0	348.53	9.64N
+ 7 00 00	+47 50 16	1 59 06	21	86	2.65	4.0	348.57	9.60N
+ 7 30 00	+47 58 14	1 59 24	21	86	2.59	4.1	348.60	9.56N
+ 8 00 00	+48 06 07	1 59 42	21	86	2.54	4.1	348.64	9.52N
+ 8 30 00	+48 13 56	2 00 00	22	87	2.49	4.2	348.68	9.48N
+ 9 00 00	+48 21 41	2 00 18	22	87	2.44	4.2	348.72	9.44N
+ 9 30 00	+48 29 21	2 00 37	23	88	2.40	4.2	348.76	9.40N
+ 10 00 00	+48 36 56	2 00 56	23	88	2.35	4.3	348.80	9.36N

1275 is a Double Star: 6.4 & 6.4, Sepn 0.10, PA 100
Graze Path of Secondary 0.02km N, and 0.2 secs. later cf. primary.

Librations Long +5.65 Lat +1.14 P 348.9 D -2.0
Illumination of moon 29%-
Elongation of Moon 65°
Vertical Profile Scale 2.23 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.88 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
5.4	5.6	7.1	7.9	8.4	8.7	9.0	9.1
7.4	5.7	7.1	7.9	8.4	8.7	9.0	9.2
9.4	5.7	7.1	7.9	8.4	8.8	9.0	9.2
11.4	5.7	7.1	7.9	8.4	8.8	9.0	9.2
13.4	5.7	7.1	7.9	8.4	8.8	9.1	9.2

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Grazing Occultation near Freiburg
Grazing Occultation of 306 F0 Mag 6.8
Sunday 1999 October 24

Nominal Site Altitude 280 m
Closest distance to graze path is 54km at azimuth 321

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 02 13	22 18 35	47	152	0.94	332.9	353.21	89.99S
+ 5 30 00	+47 18 57	22 19 33	47	153	0.94	332.9	353.25	89.97N
+ 6 00 00	+47 35 33	22 20 31	47	154	0.94	333.0	353.29	89.94N
+ 6 30 00	+47 52 00	22 21 28	47	155	0.94	333.0	353.34	89.90N
+ 7 00 00	+48 08 19	22 22 24	47	156	0.94	333.1	353.39	89.86N
+ 7 30 00	+48 24 28	22 23 20	47	158	0.94	333.1	353.44	89.82N
+ 8 00 00	+48 40 28	22 24 15	47	159	0.94	333.2	353.49	89.78N
+ 8 30 00	+48 56 19	22 25 09	47	160	0.95	333.2	353.54	89.74N

+ 9 00 00	+49 12 01	22 26 03	46	161	0.95	333.3	353.59	89.69N
+ 9 30 00	+49 27 32	22 26 57	46	162	0.95	333.3	353.64	89.65N
+ 10 00 00	+49 42 54	22 27 49	46	163	0.96	333.4	353.70	89.60N

C A S S I N I R E G I O N G R A Z E

Librations Long -3.15 Lat +7.17 P 353.3 D -6.5
Illumination of moon 100%-
Elongation of Moon 174°
Vertical Profile Scale 2.55 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.61 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
85.6	4.5	6.0	6.7	7.2	7.5	7.8	7.9
87.6	4.5	6.0	6.7	7.2	7.5	7.8	7.9
89.6	4.5	6.0	6.7	7.2	7.5	7.8	7.9
91.6	4.5	6.0	6.7	7.2	7.5	7.8	7.9
93.6	4.5	6.0	6.7	7.2	7.5	7.8	7.9

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Grazing Occultation near Freiburg
Grazing Occultation of 98430mA0 Mag 7.8
Monday 1999 November 1

Nominal Site Altitude 280 m
Closest distance to graze path is 18km at azimuth 342

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+47 31 52	0 46 41	18	85	3.14	7.7	349.14	9.53N
+ 5 30 00	+47 38 41	0 46 55	18	85	3.07	7.8	349.19	9.49N
+ 6 00 00	+47 45 25	0 47 10	18	85	3.00	7.8	349.23	9.45N
+ 6 30 00	+47 52 04	0 47 24	19	86	2.93	7.8	349.27	9.41N
+ 7 00 00	+47 58 39	0 47 39	19	86	2.87	7.9	349.31	9.36N
+ 7 30 00	+48 05 10	0 47 55	20	87	2.81	7.9	349.36	9.32N
+ 8 00 00	+48 11 36	0 48 10	20	87	2.75	8.0	349.40	9.27N
+ 8 30 00	+48 17 57	0 48 26	20	88	2.70	8.0	349.45	9.23N
+ 9 00 00	+48 24 14	0 48 42	21	88	2.64	8.1	349.49	9.18N
+ 9 30 00	+48 30 26	0 48 59	21	89	2.59	8.1	349.54	9.14N
+ 10 00 00	+48 36 33	0 49 15	21	89	2.54	8.2	349.59	9.09N

98430 is a Double Star: 8.1 & 8.6, Sepn 1.80, PA 54
Graze Path of Secondary 2.77km S, and 2.5 secs. later cf. primary.

Librations Long +7.19 Lat -0.31 P 349.5 D -0.7
Illumination of moon 44%-
Elongation of Moon 83°
Vertical Profile Scale 2.18 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.87 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
5.1	5.4	6.9	7.6	8.1	8.4	8.6	8.7
7.1	5.5	6.9	7.6	8.1	8.4	8.6	8.8
9.1	5.5	6.9	7.6	8.1	8.4	8.6	8.8
11.1	5.5	6.9	7.7	8.1	8.5	8.7	8.8
13.1	5.5	6.9	7.7	8.2	8.5	8.7	8.9

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Grazing Occultation near Freiburg
Grazing Occultation of 119442 G0 Mag 8.5
Thursday 1999 December 2

Nominal Site Altitude 280 m

Closest distance to graze path is 64km at azimuth 30

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+49 42 17	5 28 20	35	142	1.44	207.7	183.86	2.40S
+ 5 30 00	+49 32 00	5 29 00	35	143	1.42	207.8	183.96	2.49S
+ 6 00 00	+49 21 32	5 29 41	36	144	1.40	207.9	184.06	2.59S
+ 6 30 00	+49 10 54	5 30 23	36	144	1.38	208.0	184.15	2.69S
+ 7 00 00	+49 00 05	5 31 05	36	145	1.36	208.1	184.25	2.79S
+ 7 30 00	+48 49 06	5 31 48	37	146	1.34	208.2	184.35	2.88S
+ 8 00 00	+48 37 56	5 32 32	37	147	1.32	208.3	184.45	2.98S
+ 8 30 00	+48 26 36	5 33 17	38	147	1.30	208.4	184.55	3.08S
+ 9 00 00	+48 15 04	5 34 02	38	148	1.28	208.5	184.65	3.18S
+ 9 30 00	+48 03 22	5 34 49	38	149	1.26	208.6	184.75	3.28S
+ 10 00 00	+47 51 28	5 35 36	-12 39	150	1.24	208.7	184.85	3.38S

C A S S I N I R E G I O N G R A Z E

Librations Long +7.27 Lat -5.26 P 184.2 D -5.6
Illumination of moon 27%-
Elongation of Moon 63°
Vertical Profile Scale 2.30 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.45 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
-0.6	3.3	4.7	5.5	5.9	6.2	6.4	6.6
1.4	5.1	6.6	7.4	7.9	8.3	8.5	8.7
3.4	5.2	6.6	7.4	7.9	8.3	8.5	8.7
5.4	5.9	7.4	8.2	8.8	9.2	9.5	9.7
7.4	6.0	7.4	8.2	8.8	9.2	9.5	9.7

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Grazing Occultation near Freiburg
Grazing Occultation of 139144 F0 Mag 8.4
Thursday 1999 December 30

Nominal Site Altitude 280 m
Closest distance to graze path is 73km at azimuth 222

Longitude	Latitude	UT	Alt	Az	TanZ	PA	WA	CA
o ' ''	o ' ''	h m s	Sn Mn	o		o	o	o
+ 5 00 00	+48 50 52	6 00 27	39	176	1.25	209.6	186.85	6.55S
+ 5 30 00	+48 33 18	6 01 27	39	177	1.24	209.7	186.92	6.61S
+ 6 00 00	+48 15 32	6 02 28	39	178	1.22	209.8	186.99	6.68S
+ 6 30 00	+47 57 35	6 03 30	40	179	1.21	209.8	187.05	6.74S
+ 7 00 00	+47 39 28	6 04 34	-12 40	180	1.20	209.9	187.11	6.80S
+ 7 30 00	+47 21 10	6 05 38	-11 40	181	1.18	210.0	187.17	6.86S
+ 8 00 00	+47 02 41	6 06 44	-11 40	182	1.17	210.0	187.23	6.92S
+ 8 30 00	+46 44 02	6 07 50	-10 41	183	1.16	210.1	187.28	6.98S
+ 9 00 00	+46 25 13	6 08 57	-10 41	184	1.15	210.1	187.34	7.03S
+ 9 30 00	+46 06 15	6 10 06	-9 41	185	1.14	210.2	187.39	7.08S
+ 10 00 00	+45 47 07	6 11 15	-8 42	186	1.13	210.2	187.44	7.13S

C A S S I N I R E G I O N G R A Z E

Librations Long +7.26 Lat -5.77 P 186.7 D -6.4
Illumination of moon 43%-
Elongation of Moon 82°
Vertical Profile Scale 2.65 km/arcsec at mean distance of moon
Horizontal Scale Factor 1.38 deg/min

Limiting magnitudes for Different Telescope Apertures (mm)

CA\TDia	50	100	150	200	250	300	350
3.1	5.0	6.4	7.2	7.7	8.1	8.3	8.5
5.1	5.8	7.3	8.1	8.6	9.0	9.2	9.4
7.1	5.8	7.3	8.1	8.6	9.0	9.2	9.5

9.1	5.8	7.3	8.1	8.6	9.0	9.3	9.5
11.1	5.8	7.3	8.1	8.6	9.0	9.3	9.5