

Outdoor Lab 7 - Double Stars

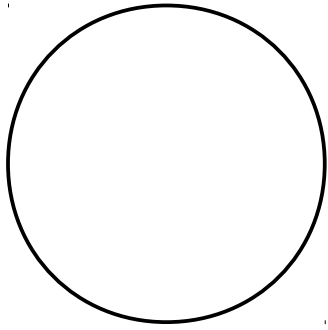
Objective: To observe the characteristics of some double stars.

1 Double Stars

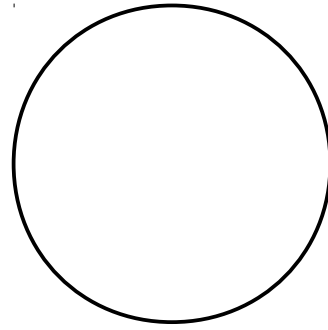
Double stars have played an important role in astronomy. By observing the orbits of double stars, one can calculate the masses of the component stars. They are also useful as an optical test, both of your telescope optics and of the seeing conditions.

2 Observations

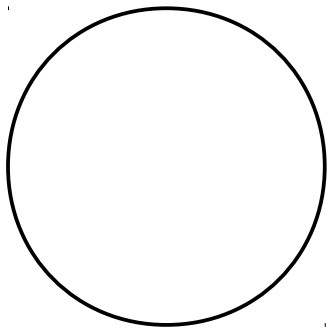
1. Record the time and date.
2. There is a list of double stars, ordered by RA, on pages 3 and 4. Given the time of year, you should be able to decide which RA range will be most visible. You also will want to choose double stars with different separations. Anything over 5" should be easy, less than this is more challenging. Based on these considerations, select at least five objects that you will search for during the observing sessions.
3. Find each object, using nearby bright stars and "star-hopping" to arrive at the object you are seeking. Try using eyepieces of different focal length. Depending on the object, lower or higher power may give a better view.
4. Estimate the separation and position angle of the double. You can estimate the separation by timing how long the star takes to drift through the field of view. An object on the equator will move 360° in 24 hours, or $900''$ /minute. For an object at declination δ this is reduced by $\cos(\delta)$, so the object will move $900 \times \cos(\delta)$ "/minute. Position angle is a little more difficult, since you need to determine the orientation of the field. Position angle is defined with $N = 0^\circ$ increasing toward the east, just like azimuth. Again, by watching the stars drift through the field (they will drift toward the west), you should be able to determine the field orientation.
5. Sketch the double and record the separation and position angle in the charts on page 2. Note any differences in magnitude and color.
6. Repeat the above for all of the objects on your list.



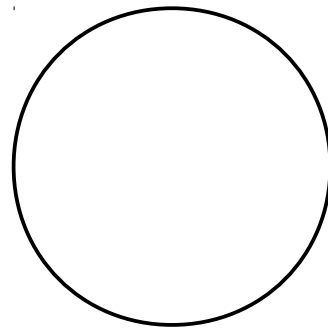
Date = _____ Time = _____
 RA/Dec = _____ Constellation = _____
 Separation(") = _____ PositionAngle(°) = _____
 Notes _____



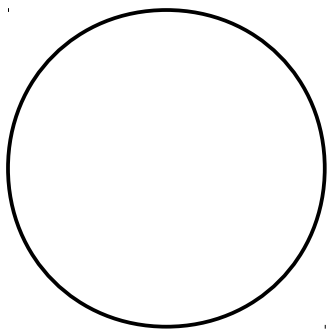
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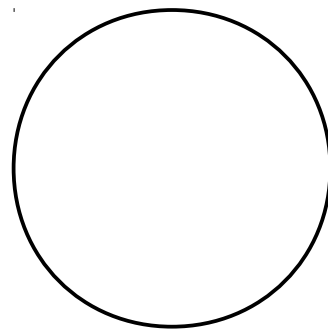
Date = _____ Time = _____
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Sheet1

Index	Object	Ascension	Declination	Magnitude.	Separation	Angle
1	Eta Cassiopeiae	00h 49m.1	+57° 49'	3.4, 7.5	12"	307°
2	65 Piscium	00h 49m.9	+27° 43'	6.3, 6.3	4.4"	297°
3	Psi 1 Piscium	01h 05m.6	+21° 28'	5.6, 5.8	30"	159°
4	Zeta Piscium	01h 13m.7	+07° 35'	5.6, 6.5	23"	63°
5	Gamma Arietis	01h 53m.5	+19° 18'	4.8, 4.8	7.8"	0°
6	Lambda Arietis	01h 57m.9	+23° 36'	4.9, 7.7	37"	46°
7	Alpha Piscium	02h 02m.0	+02° 46'	4.2, 5.1	1.7"	50°
8	Gamma Andromedae	02h 03m.9	+42° 20'	2.3, 5.5	9.8"	63°
9	Iota Trianguli	02h 12m.4	+30° 18'	5.3, 6.9	3.9"	71°
10	Alpha Ursa Minoris	02h 31m.8	+89° 16'	2.0, 9.0	18.4"	218°
11	Gamma Ceti	02h 43m.3	+03° 14'	3.5, 7.3	2.8"	294°
12	Eta Persei	02h 50m.7	+55° 54'	3.8, 8.5	28.3"	300°
13	Struve 331	03h 00m.9	+52° 21'	5.3, 6.7	12.1"	85°
14	32 Eridani	03h 54m.3	-02° 57'	4.8, 6.1	6.8"	347°
15	Chi Tauri	04h 22m.6	+25° 38'	5.5, 7.6	19.4"	24°
16	1 Camelopardalis	04h 32m.0	+53° 55'	5.7, 6.8	10.3"	308°
17	55 Eridani	04h 43m.6	-08° 48'	6.7, 6.8	9.2"	317°
18	Beta Orionis	05h 14m.5	-08° 12'	0.1, 6.8	9.5"	202°
19	118 Tauri	05h 29m.3	+25° 09'	5.8, 6.6	4.8"	204°
20	Delta Orionis	05h 32m.0	-00° 18'	2.2, 6.3	52.6"	359°
21	Struve 747	05h 35m.0	-06° 00'	4.8, 5.7	35.7"	223°
22	Lamda Orionis	05h 35m.1	+09° 56'	3.6, 5.5	4.4"	43°
23	Theta 1 Orionis	05h 35m.3	-05° 23'	5.1, 6.7	21.5"	31°, 132°, 96°
24	Iota Orionis	05h 35m.4	-05° 55'	2.8, 6.9	11.3"	141°
25	Theta 2 Orionis	05h 35m.4	-05° 25'	5.2, 6.5	52"	92°
26	Sigma Orionis	05h 38m.7	-02° 36'	4.0, 7.5, 6.5	12.9", 43"	84°, 61°
27	Zeta Orionis	05h 40m.8	-01° 57'	1.9, 4.0, 9.9	2.4", 58"	162°, 10°
28	Gamma Leporis	05h 44m.5	-22° 27'	3.7, 6.3	96"	350°
29	Theta Aurigae	05h 59m.7	+37° 13'	2.6, 7.1	3.6"	313°
30	Epsilon Monocerotis	06h 23m.8	+04° 36'	4.5, 6.5	13.4"	27°
31	Beta Monocerotis	06h 28m.8	-07° 02'	4.7, 5.2	7.3"	132°
32	12 Lyncis	06h 46m.2	+59° 27'	5.4, 7.3	8.7"	308°
33	Epsilon Canis Majoris	06h 58m.6	-28° 58'	1.5, 7.4	7.5"	161°
34	Delta Geminorum	07h 20m.1	+21° 59'	3.5, 8.2	6.8"	211°
35	19 Lyncis	07h 22m.9	+55° 17'	5.6, 6.5	14.8"	315°
36	Alpha Geminorum	07h 34m.6	+31° 53'	1.9, 2.9	2.2"	171°
37	Kappa Puppis	07h 38m.8	-26° 48'	4.5, 4.7	9.9"	318°
38	Zeta Cancri	08h 12m.2	+17° 39'	5.6, 6.0	5.9"	89°
39	Iota Cancri	08h 46m.7	+28° 46'	4.2, 6.6	30"	307°
40	38 Lyncis	09h 18m.8	+36° 48'	3.9, 6.6	2.7"	229°
41	Alpha Leonis	10h 08m.4	+11° 58'	1.4, 7.7	177"	307°
42	Gamma Leonis	10h 20m.0	+19° 51'	2.2, 3.5	4.4"	122°
43	54 Leonis	10h 55m.6	+24° 45'	4.5, 6.3	6.5"	110°
44	N Hydrae	11h 32m.3	-29° 16'	5.8, 5.9	9.2"	210°
45	Delta Corvi	12h 29m.9	-16° 31'	3.0, 9.2	24.2"	214°
46	24 Comae Berenices	12h 35m.1	+18° 23'	5.2, 6.7	20.3"	271°
47	Gamma Virginis	12h 41m.7	-01° 27'	3.5, 3.5	3.6"	293°
48	32 Camelopardalis	12h 49m.2	+83° 25'	5.3, 5.8	21.6"	326°
49	Alpha Canum Venaticorum	12h 56m.0	+38° 19'	2.9, 5.5	19.4"	229°
50	Zeta Ursa Majoris	13h 23m.9	+54° 56'	2.3, 4.0, 4.0	14.4", 709"	152°, 71°
51	Kappa Bootis	14h 13m.5	+51° 47'	4.6, 6.6	13.4"	236°
52	Iota Bootis	14h 16m.2	+51° 22'	4.9, 7.5	38"	33°

Sheet1

53 Pi Bootis	14h 40m.7	+16° 25'	4.9, 5.8	5.6"	108°
54 Epsilon Bootis	14h 45m.0	+27° 04'	2.5, 4.9	2.8"	339°
55 Alpha Librae	14h 50m.9	-16° 02'	2.8, 5.2	231"	314°
56 Xi Bootis	14h 51m.4	+19° 06'	4.7, 7.0	6.9"	332°
57 Delta Bootis	15h 15m.5	+33° 19'	3.5, 8.7	105"	79°
58 Mu Bootis	15h 24m.5	+37° 23'	4.3, 7.0	108"	171°
59 Delta Serpentis	15h 34m.8	+10° 32'	4.2, 5.2	3.9"	178°
60 Zeta Corona Borealis	15h 39m.4	+36° 38'	5.1, 6.0	6.3"	305°
61 Xi Scorpis	16h 04m.4	-11° 22'	4.8, 7.3	7.6"	51°
62 Struve 1999	16h 04m.4	-11° 27'	7.4, 8.1	11.6"	99°
63 Beta Scorpis	16h 05m.4	-19° 48'	2.6, 4.9	13.6"	21°
64 Kappa Herculis	16h 08m.1	+17° 03'	5.3, 6.5	28"	12°
65 Nu Scorpis	16h 12m.0	-19° 28'	4.3, 6.4	41"	337°
66 Sigma Corona Borealis	16h 14m.7	+33° 52'	5.6, 6.6	6.2"	233°
67 16/17 Draconis	16h 36m.2	+52° 55'	5.4, 6.4, 5.5	3.4, 90	108°, 194°
68 Mu Draconis	17h 05m.3	+54° 28'	5.7, 5.7	2.0"	42°
69 Alpha Herculis	17h 14m.6	+14° 23'	3.5, 5.4	4.7"	107°
70 Delta Herculis	17h 15m.0	+24° 50'	3.1, 8.2	8.9"	236°
71 36 Ophiuchi	17h 15m.3	-26° 36'	5.1, 5.1	4.4"	154°
72 Omicron Ophiuchi	17h 18m.0	-24° 17'	5.4, 6.9	10.3"	355°
73 Rho Herculis	17h 23m.7	+37° 09'	4.6, 5.6	4.1"	316°
74 Nu Draconis	17h 32m.2	+55° 11'	4.9, 4.9	62"	312°
75 Psi Draconis	17h 41m.9	+72° 09'	4.9, 6.1	30.3"	15°
76 40/41 Draconis	18h 00m.2	+80° 00'	5.7, 6.1	19.3"	232°
77 95 Herculis	18h 01m.5	+21° 36'	5.0, 5.1	6.3"	258°
78 70 Ophiuchi	18h 05m.5	+02° 30'	4.2, 6.0	2.8"	72°
79 Epsilon Lyrae	18h 44m.3	+39° 40'	5.2, 5.5	2.3"	357°, 173°, 94°
80 Zeta Lyrae	18h 44m.8	+37° 36'	4.3, 5.9	44"	150
81 Beta Lyrae	18h 50m.1	+33° 22'	3.4, 8.6	46"	149°
82 Struve 2404	18h 50m.8	+10° 59'	6.9, 8.1	3.6"	183°
83 Otto Struve 525	18h 54m.9	+33° 58'	6.0, 7.7	45"	350°
84 Theta Serpentis	18h 56m.2	+04° 12'	4.5, 5.4	22.3"	104°
85 Beta Cygni	19h 30m.7	+27° 58'	3.1, 5.1	34.4"	54°
86 57 Aquilae	19h 54m.6	-08° 14'	5.8, 6.5	36"	170°
87 31 Cygni	20h 13m.6	+46° 44'	3.8, 6.7, 4.8	107", 337"	173°, 323°
88 Alpha Capricornus	20h 18m.1	-12° 33'	3.6, 4.2	378"	291°
89 Beta Capricornus	20h 21m.0	-14° 47'	3.4, 6.2	206"	267°
90 Gamma Delphinus	20h 46m.7	+16° 07'	4.5, 5.5	9.6"	268°
91 61 Cygni	21h 06m.9	+38° 45'	5.2, 6.0	28"	146°
92 Beta Cephei	21h 28m.7	+70° 34'	3.2, 7.9	13.3"	249°
93 Struve 2816	21h 39m.0	+57° 29'	5.6, 7.7, 7.8	11.7", 20"	121°, 339°
94 Epsilon Pegasi	21h 44m.2	+09° 52'	2.4, 8.4	142"	320°
95 Xi Cephei	22h 03m.8	+64° 38'	4.4, 6.5	7.7"	277°
96 Zeta Aquarii	22h 28m.8	-00° 01'	4.3, 4.5	1.8"	266°
97 Delta Cephei	22h 29m.2	+58° 25'	3.9, 6.3	41"	192°
98 8 Lacerta	22h 35m.9	+39° 38'	5.7, 6.5	22.4"	186°
99 94 Aquarii	23h 19m.1	-13° 28'	5.3, 7.3	12.7"	350°
100 Sigma Cassiopeiae	23h 59m.0	+55° 45'	5.0, 7.1	3"	326°