Testing Your Binocular's Limits With Binaries!

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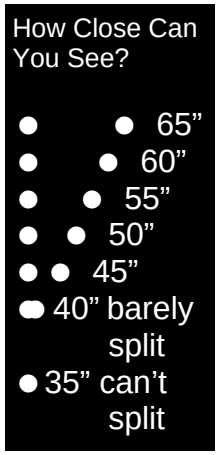
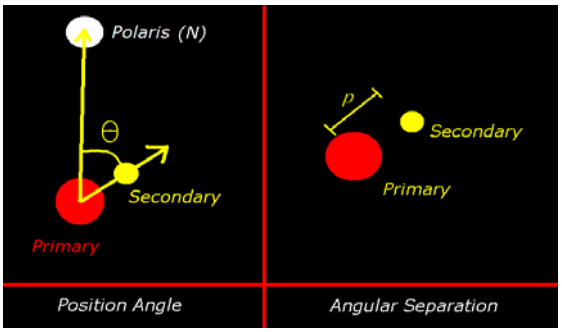
Can you see it? Test your eye + binocular limits in closeness and brightness with binaries.

Binary stars (also known as 'doubles') are among the most interesting objects in the sky. The two stars can be similar or vastly different in brightness (magnitude), they can be widely separated or challengingly close, and their colors can range from similar to highly contrasted, with red and blue pairs among the most picturesque sights in the heavens. Whether you look with the unaided eye or with optical devices, you either see both stars, or you don't. The question is, what are your limits in brightness and separation below which you can not detect the secondary star?



This observing exercise will help you to predict if a particular pair can be seen in binoculars, based on how close together two stars can be, and how bright the secondary must be. Note that we do not care if the two stars are physically connected and orbiting around each other. Some doubles are optical pairs—merely two stars in the same line of sight and nowhere physically near each other. But here only the brightness of the secondary star (which is always the fainter one) and the separation is important.



Double stars are described in terms of the secondary (B) star's separation and angle around the primary (A) star.

Some terms and some caveats...our quest is to see the fainter of the two stars, called the companion or **B** star of the pair. Common binoculars rarely view stars much fainter than magnitude 8 or 9. We've always done this from urban skies so perhaps observers in darker places, or those using more high-powered or image stabilized binoculars will have different results. **Separation** is in seconds of arc (symbol -- ") and we are examining those ranging from about 200" down to the likely unreachable 10" separation. As an aid, one also needs the **position angle** the B star makes around the A star (brighter of the pair) at its center, North being 0^{o}, moving counterclockwise towards 90^{o} in the East, and so on. Lastly, it is known that the greater the **magnitude difference** between the A and B stars, the harder it often is to see the B star! Thus two pairs of stars at the same separation, but one pair having 5 magnitudes of difference and the other pair with 0.5-magnitude difference, may have you seeing only the latter.

Your assignment is to observe as many doubles on the list for this season as you can find, to determine how close the stars can be before you cannot 'split' them (they are too close to see) and to use the companion star to also see how faint you can see with your pair of binoculars. After you have found the double star, look to see if you can observe the companion. It will be quite close to the star for all but the widest pairs given. After you have made your effort, record a Y or N (yes or no) if you could see the companion star. The results of your observations would be placed on the provided graph. There you would put that Y or N at the X-Y coordinate where the values of magnitude and separation meet.

In an ideal world, you would have a vertical line at a particular seconds of arc on the X axis separating those you can split and those you can't, and a horizontal line separating those B stars bright enough to be seen and those too dim. However, there aren't enough binaries of all B-star magnitudes and all possible separations around, in any season or even all of them together, to graph truly fine limits. Further, the magnitude separation effect mentioned above will also be in play. Thus you may have two curved, gray zones instead of two lines, where *some* of the companions may be seen, depending on the

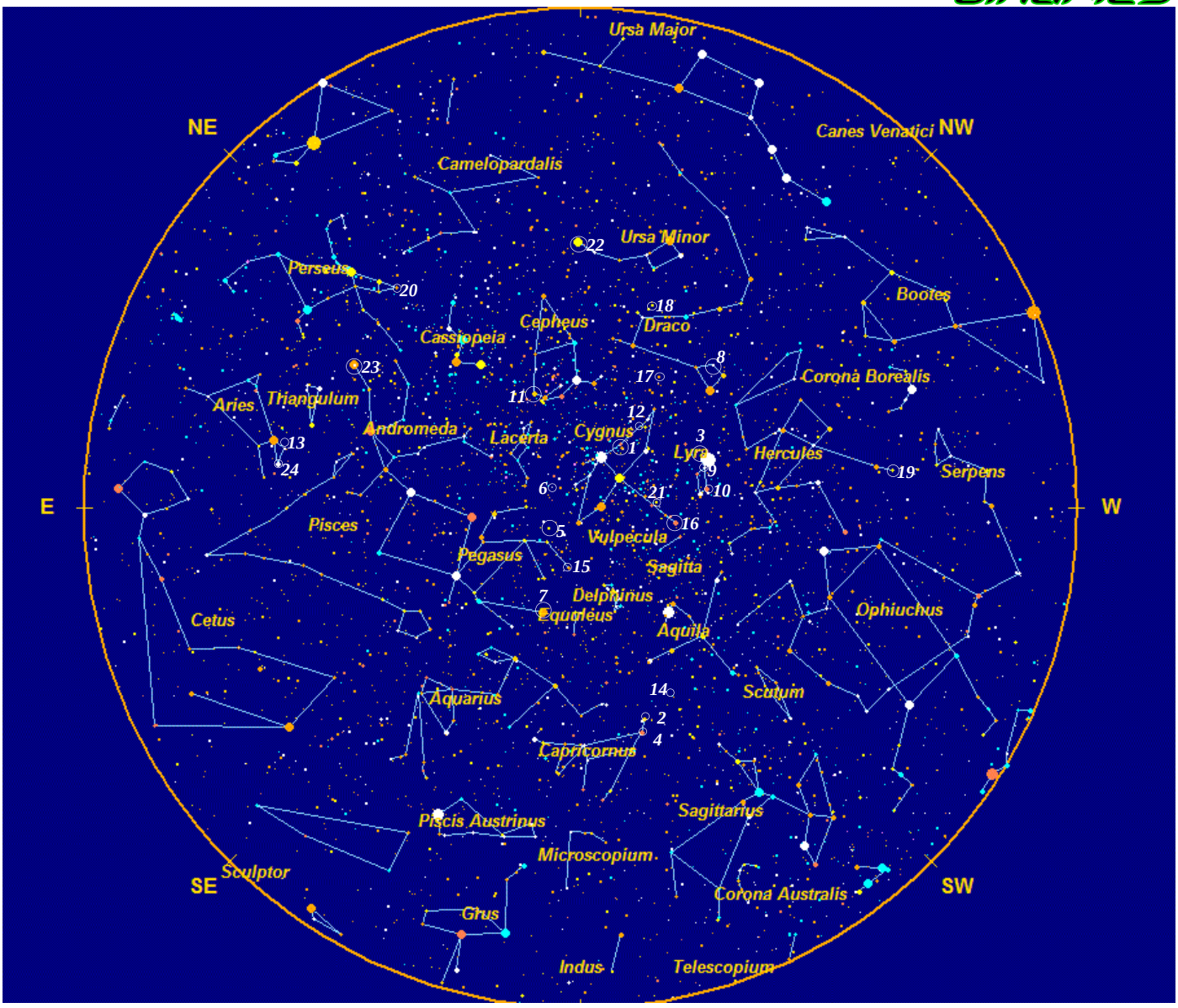
Double Stars for Finding Your Binoculars' Faintness and Closeness Limits Arranged in Order of Decreasing Separation

Chart #	Name of Double Star	A star Magnitude (Primary)	B star Magnitude (Secondary)	Separation (Seconds of arc)	Position Angle (degrees)	Comments	NCZ / NCB	B Star Observed (Y/N)
1	Omicron (31) Cygni	4	5 & 4	(B)107 & (C)338	173 & 323	Easiest triple star, A&B Orange and Blue	NCB	AB: AC:
2	Alpha Capricorni	4	4.5	291	376	Another double –double pair, both yellow		
3	Epsilon Lyrae	5	5	210	~N-S	Naked eye pair, each a double but binoculars only show the merged two pairs		
4	Beta Capricorni	3.2	6.1	206	267	Yellow and blue		
5	Mu Cygni	4.4	7.0	198				
6	79 Cygni	5.7	7.0	150	153			
7	Epsilon Pegasi	2.3	8.5	143	320			
8	Nu Draconis	5.0	5.0	62	312	Both white	NCB	
9	Beta Lyrae	3.4 (but variable)	7.8	46	149	Two challenging 9.0 companions, at (C) 67”, 318^{o} ; (D) 86”, 19^{o}		AB: AC: AD:
10	Zeta Lyrae	4.3	5.9	44	150	Yellow and Green		
11	Delta Cephei	4.2 (but variable)	6.1	41	191	Orange and Blue	NCB	
12	16 Cygni	6.0	6.2	40	133	Both orangey	NCB	
13	Lambda Arietis	5.0	6.7	37	46	Yellow and Blue		
14	57 Aquilae	6.0	6.0	36	170	Yellow and Green		
15	1 Pegasi	4.2	7.6	36	311	Orange and Violet		
16	Beta Cygni (Albireo)	3.2	4.7	34	54	Red and Blue—Best in the sky!		
17	Omicron Draconis	4.8	7.8	34	322	Green and bluish	NCB	
18	Psi Draconis	4.9	6.1	30	15	Yellow and bluish	NCZ	
19	Kappa Herculis	5.0	6.0	28	13	Yellow and Red		
20	Eta Persei	3.8	8.5	28	300	Orange and Blue	NCB	
21	17 Cygni	5.0	9.0	26	73	Red and Blue		
22	Polaris	2.1	9.1	18	232	The North Star	NCZ	
23	Gamma Andromeda	2.3	5.0	9	63	Orange and Blue		
25	Gamma Arietis	4.5	4.6	7	1	White and white		

NCZ = in North Circumpolar Zone; NCB = in North Circumpolar Border Zone (see Page 12).

Table Data from: 2012 Observer's Handbook, RASC; Binocular Highlights by Gary Seronick, Sky Publishing Corp.; Norton's Star Atlas, Sky Publishing Corp., Seasonal Star Charts, Hubbell Scientific; Sky Catalog 2000, Volume 2, Sky Publishing Corp.; Mag 6 Star Atlas, by T. Dickinson, V. Costanzo, and G. Chaple, Edmund Scientific Corp.

other characteristic. At the end, though, you should have an approximate idea of the limits of your eye+binocular combination, in terms of closeness you can split two stars, and faintness you can see. TCA



Double Star Magnitude/Separation Graph