

Stephen Tonkin

Binocular Astronomy



Second Edition

Why Binoculars?

- ★ Excellent beginners' instrument
- ★ Excellent “serious” instrument
 - ★ Portable
 - ★ Easy Set-up
 - ★ The Binocular Advantage

The Binocular Advantage

× 1.4

- ★ Statistical Summation

Improved probability of detection with two eyes

- ★ Physiological Summation

Improved SNR due to partially cancelled neural noise

plus...

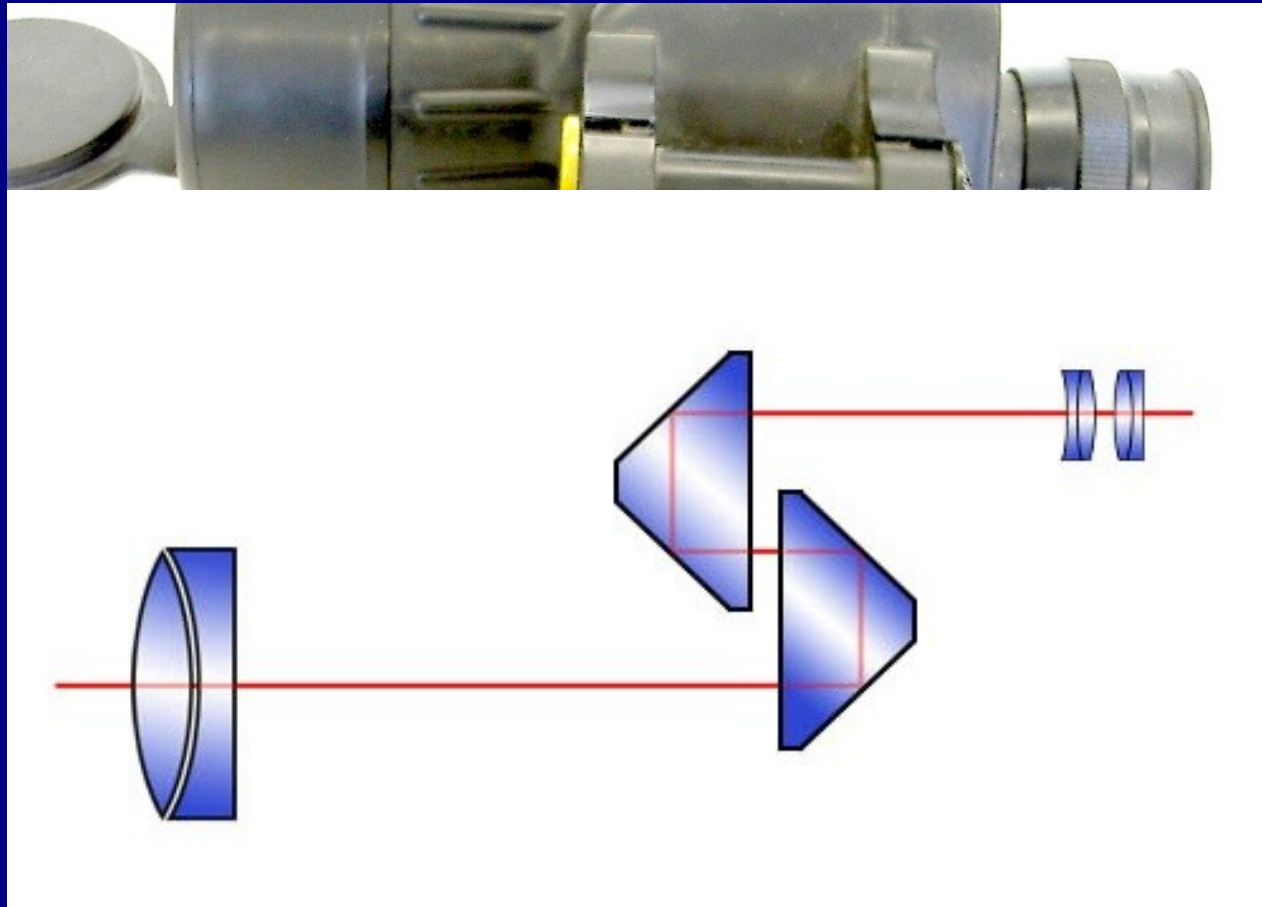
- ★ False Stereopsis

- ★ Negation of Blind Spot

Common Types of Binocular

- ★ Porro Prism
- ★ Roof Prism
- ★ 45° Eyepieces

Porro Prism



Porro Prism

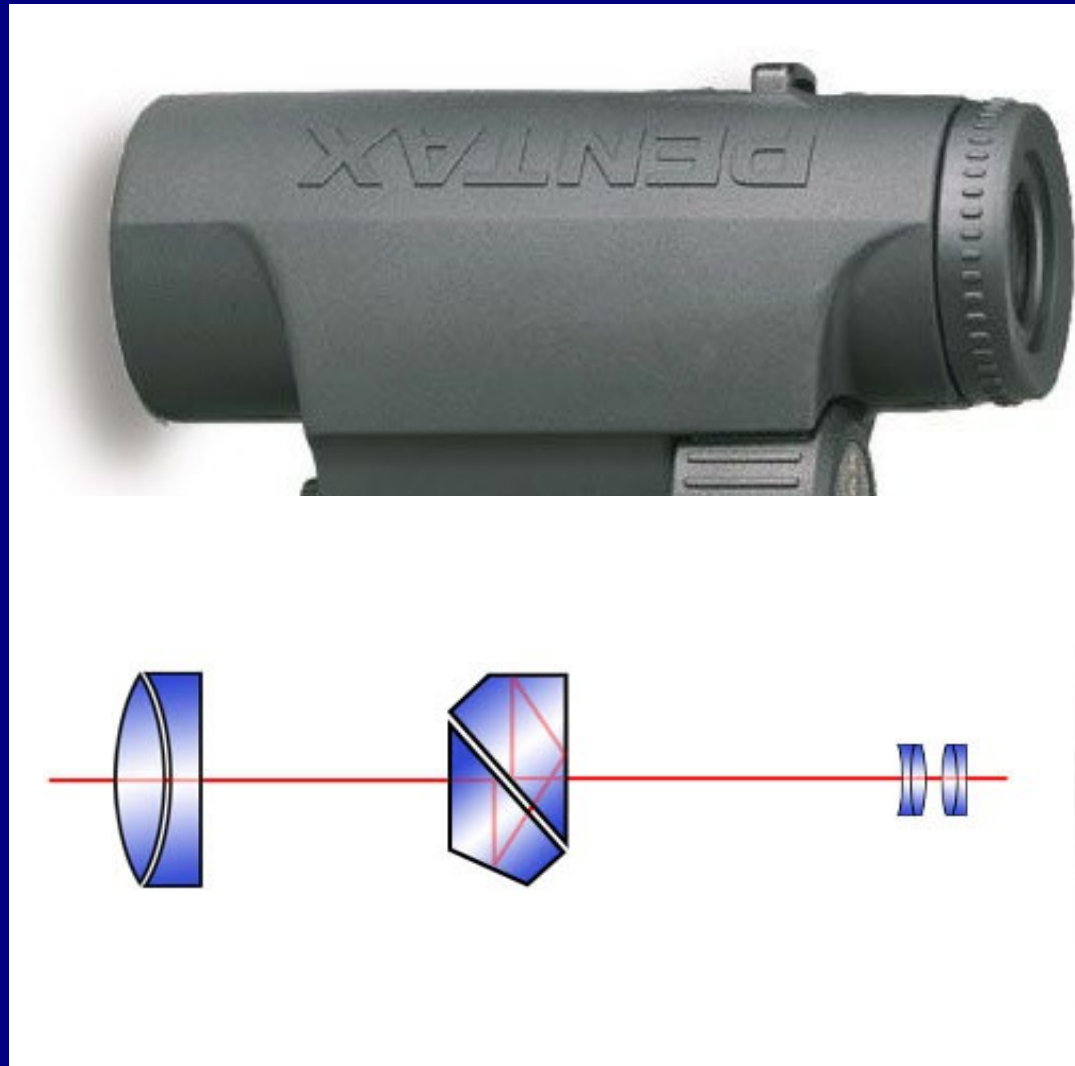
★ Advantages:

- ★ Generally best quality in a given price range
- ★ Relatively easy to maintain

★ Disadvantages:

- ★ Bulkier and heavier
- ★ Cheap ones easily lose collimation

Roof Prism



Roof Prism

★ Advantages:

- ★ Lighter and more compact than Porros
- ★ Easier to waterproof than Porros

★ Disadvantages:

- ★ More expensive than equivalent quality Porro
- ★ Much more difficult to self-maintain
- ★ Aperture is limited by “straight” design

45° (or 90°) Eyepieces



45° (or 90°) Eyepieces

★ Advantages:

- ★ **Much** more comfortable to use, especially for high elevations

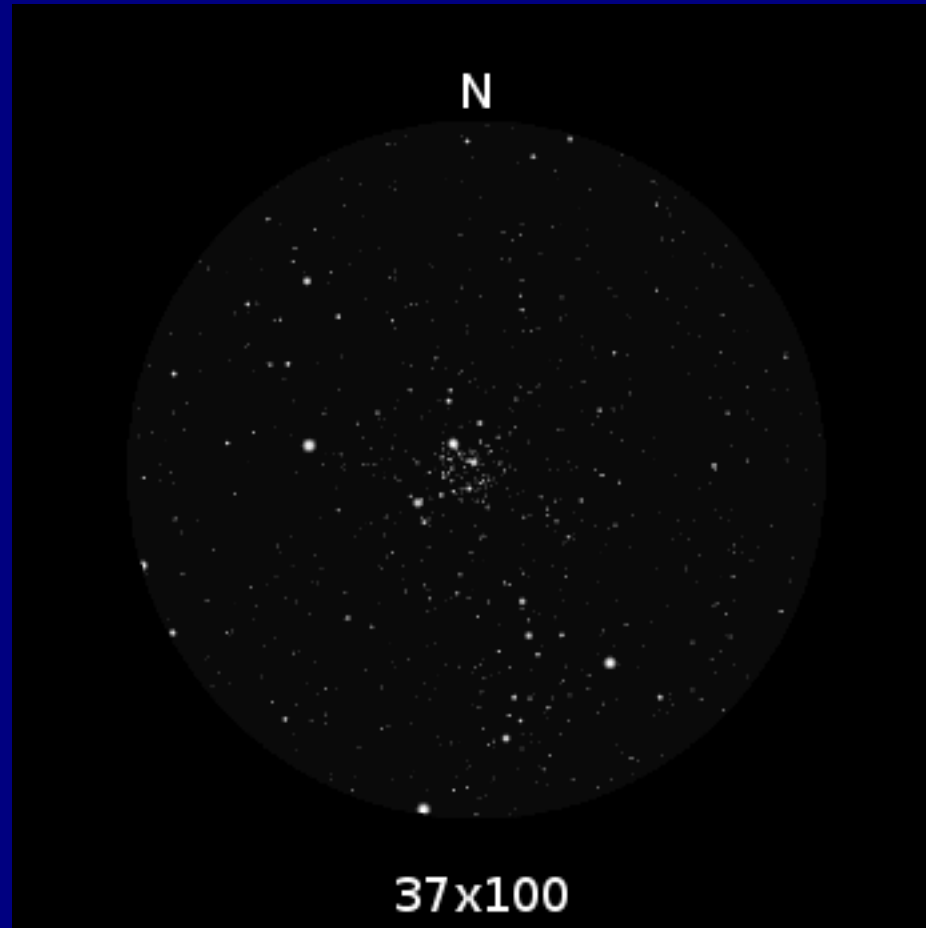
★ Disadvantages:

- ★ More expensive than “straight-through”
- ★ Must be mounted
- ★ Need some sort of finder

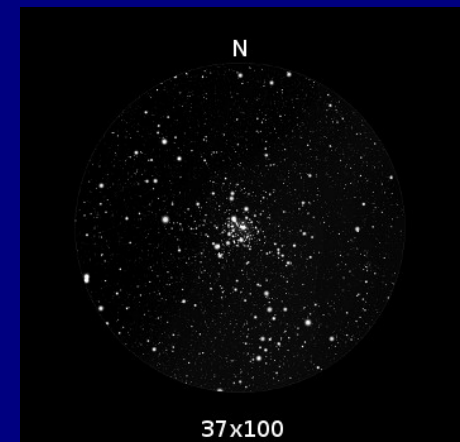
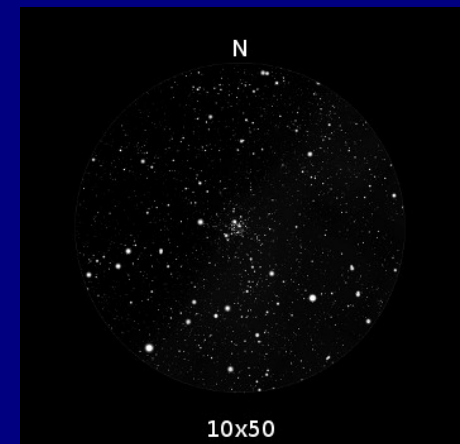
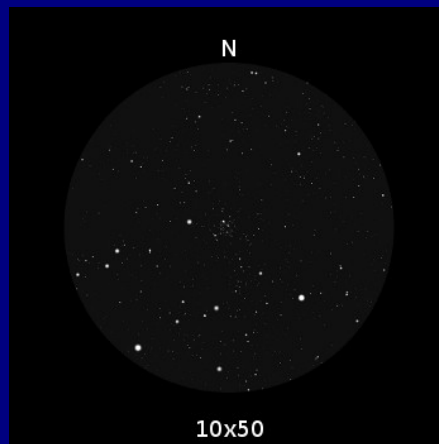
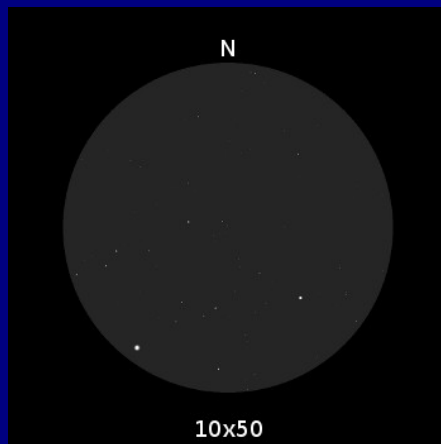
What size?

- ★ Described by two numbers:
magnification x aperture in mm
- ★ 8x40: can be easily hand-held
- ★ 10x50: most people can hand-hold
- ★ 15x70: ideally mounted, but can be hand-held for brief periods
- ★ 25x100: must be mounted

What size?



Light Pollution



Focusers



Buying Advice



“As long as you get binoculars with BaK-4 prisms and Fully Multicoated optics, you can't go far wrong.”





BaK-4 Prisms

- ★ BaK-4 prisms internally reflect more light than BK-7 prisms (but have slightly worse transmission and dispersion properties)



Glass Type	Refractive Index	Critical Angle	Dispersion
<u>Schott BaK-4</u>	1.5688	39.6°	-0.0523 μm^{-1}
Chinese BAK4	1.5525	40.1°	-0.0452 μm^{-1}
<u>Schott BK-7</u>	1.5168	41.2°	-0.0418 μm^{-1}



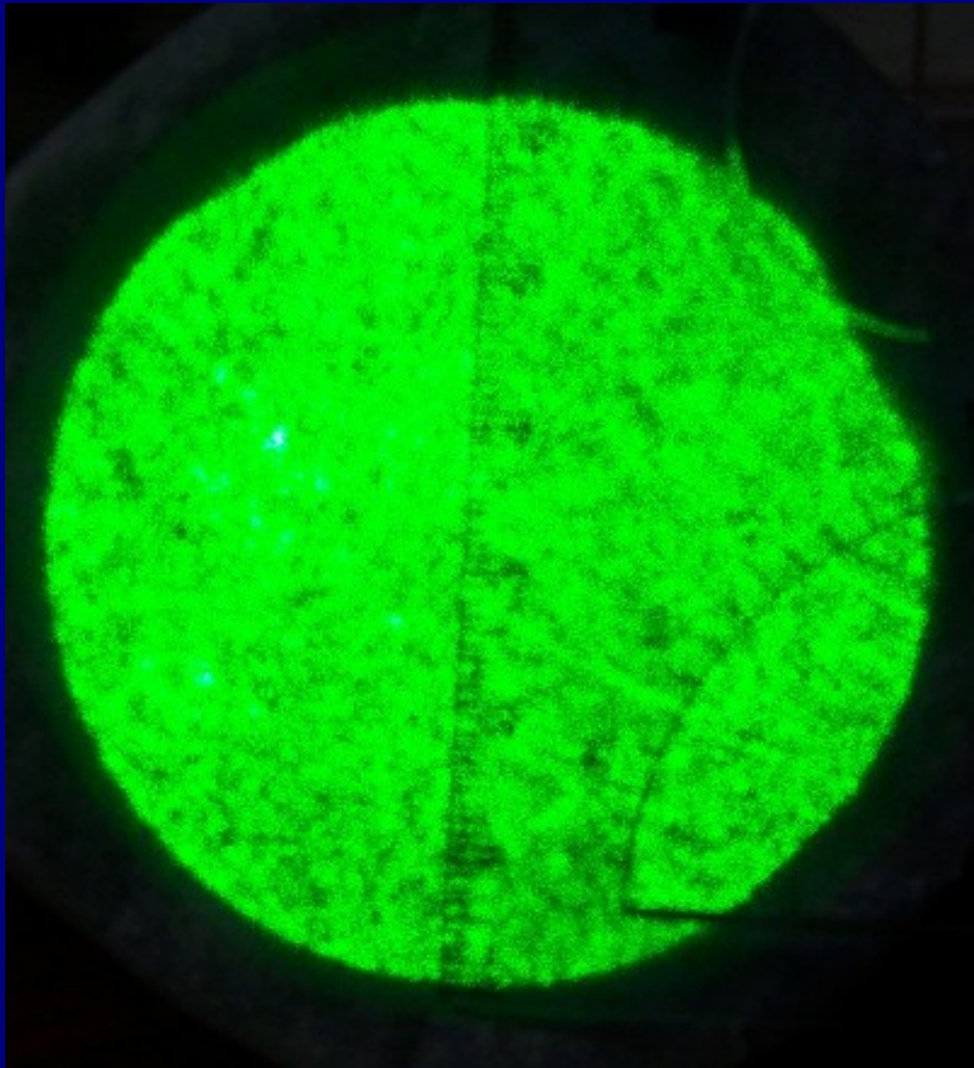
Fully Multicoated

- ★ There is no Industry-wide standard.
- ★ The air-glass surfaces of the lenses have 2-layer coatings?
- ★ All air-glass surfaces have properly applied 7-layer coatings?



Fully Broadband Multi-Coated
BAK4 Prism

Strathspey
15 x 70
77M AT 1000M





- ★ Laser: 62 mm
- ★ LED: 62.5 mm
- ★ Exit Pupil: “Just over 60mm”

Fully Broadband Multi-Coated
BAK4 Prism

Strahsley
15 x 70
77M / 1000M

With respect to coatings:

- ★ Evenness of application
- ★ Whether they are the correct thickness
- ★ Whether there are 7 layers on all glass-air surfaces, including prism hypotenuses, or whether its just 2 layers on the glass-air surfaces of the lenses.

With respect to the prisms:

- ★ Whether it's Schott BaK4 or Chinese BAK4 glass.
- ★ If the prisms are under-sized.
- ★ The precision with which the flat surfaces of the prism have been polished.
- ★ Whether the prisms hypotenuses are grooved.
- ★ Whether the prism sides are blackened.
- ★ Whether the reflective surfaces of the prisms are shielded.
- ★ How the prisms are secured into their housings.

General

- ★ Quality of internal light-baffling.
- ★ Type and quality of eyepieces.
- ★ Field curvature.
- ★ Spherical aberration.
- ★ Crispness of focus.
- ★ Edge distortion.
- ★ Amount of vignetting.
- ★ Size of fully illuminated field of view.
- ★ Chromatic aberration.
- ★ Mechanical build quality.
- ★ Smoothness of focus.
- ★ Manufacturer's quality control.

Things to Avoid

- ★ Zoom
- ★ Ruby Coatings
- ★ Focus-free
- ★ Quick-focus

Objects to Observe

Solar System

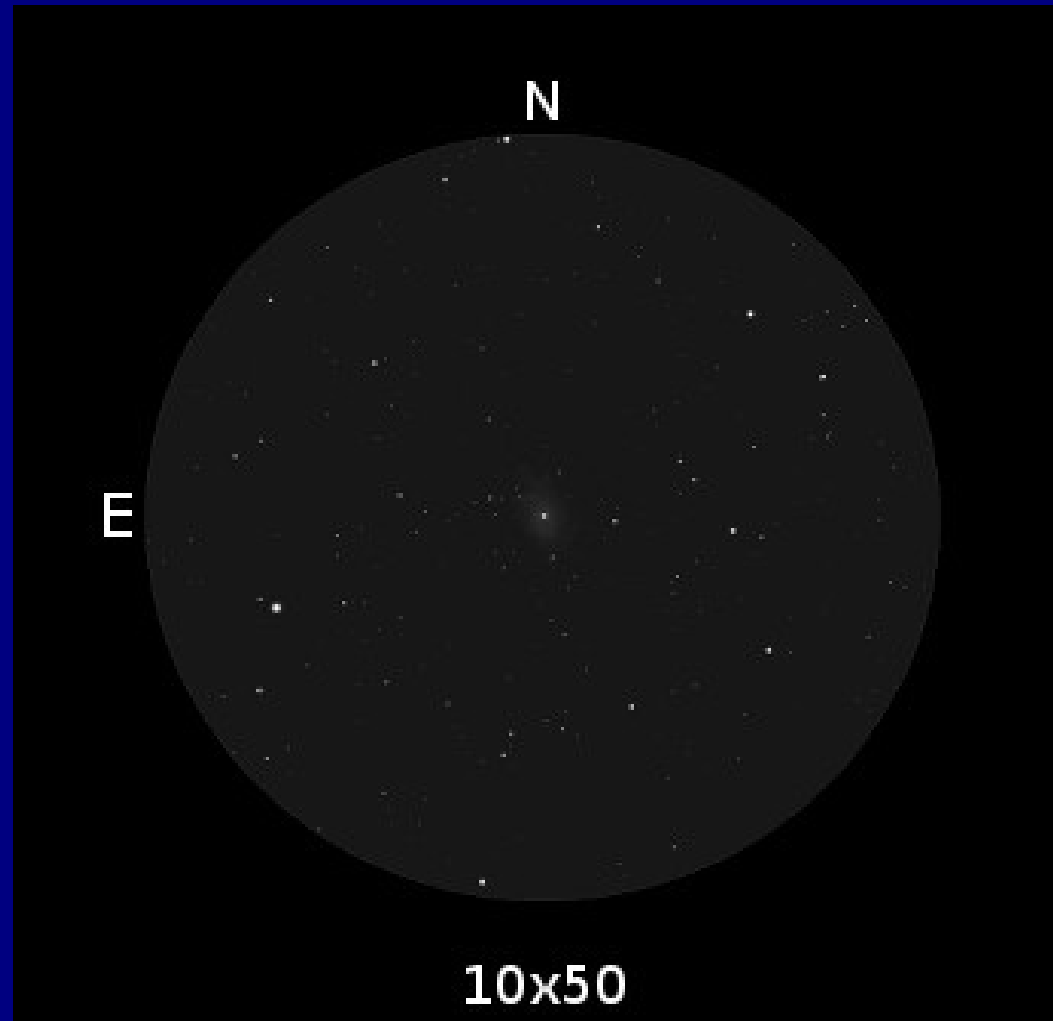
- ★ The binocular planets (Uranus, Neptune)
- ★ Brighter asteroids (Ceres, Vesta, Pallas)
- ★ Brighter comets
- ★ Meteor trains
- ★ Lunar occultations
- ★ Asteroid occultations

Objects to Observe

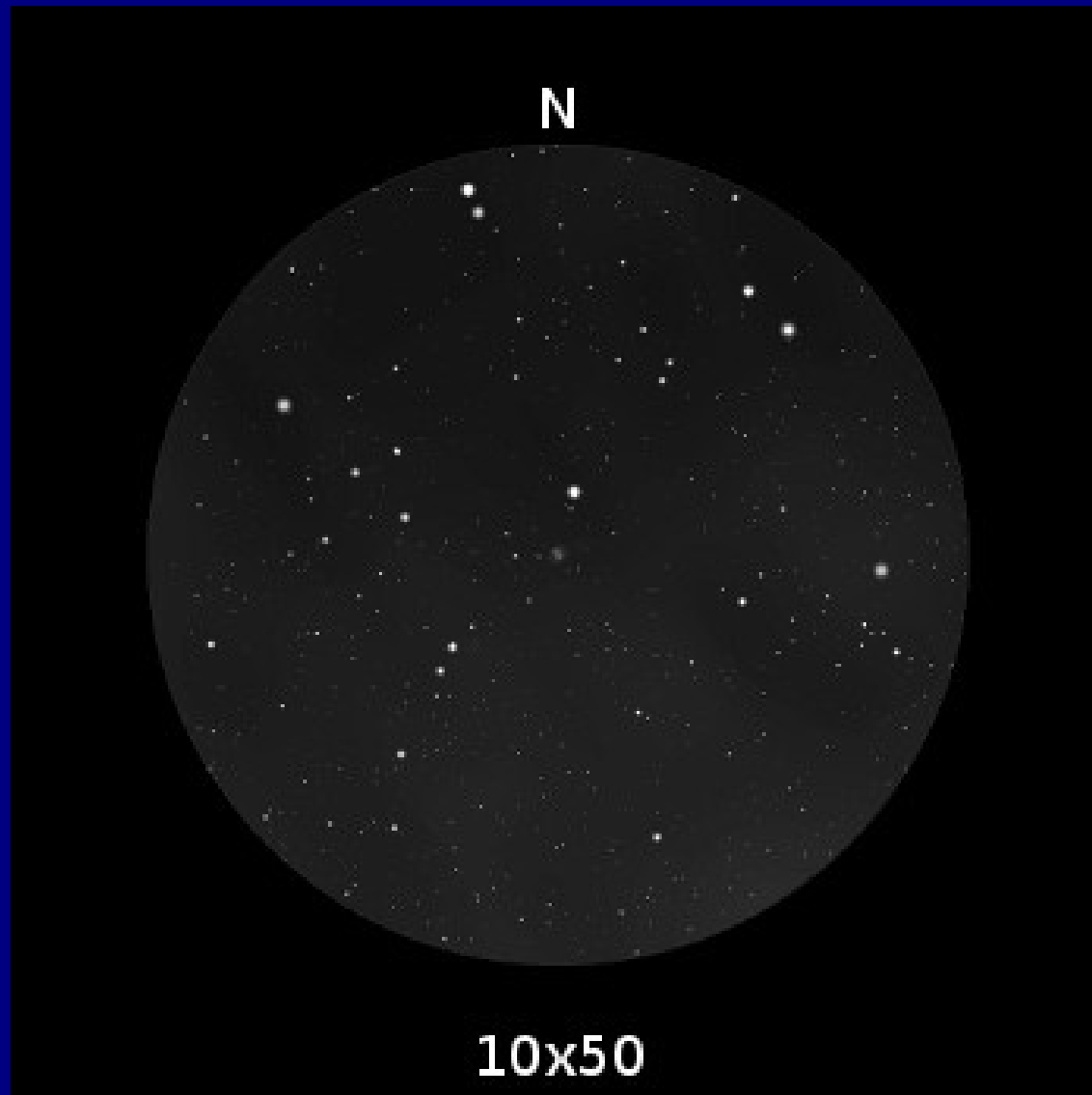
Deep Sky

- ★ Open clusters
- ★ Asterisms
- ★ Large emission nebulae
- ★ Large (faint) galaxies
- ★ Very large globular clusters
- ★ Some planetary nebulae
- ★ Variable stars
- ★ Double stars

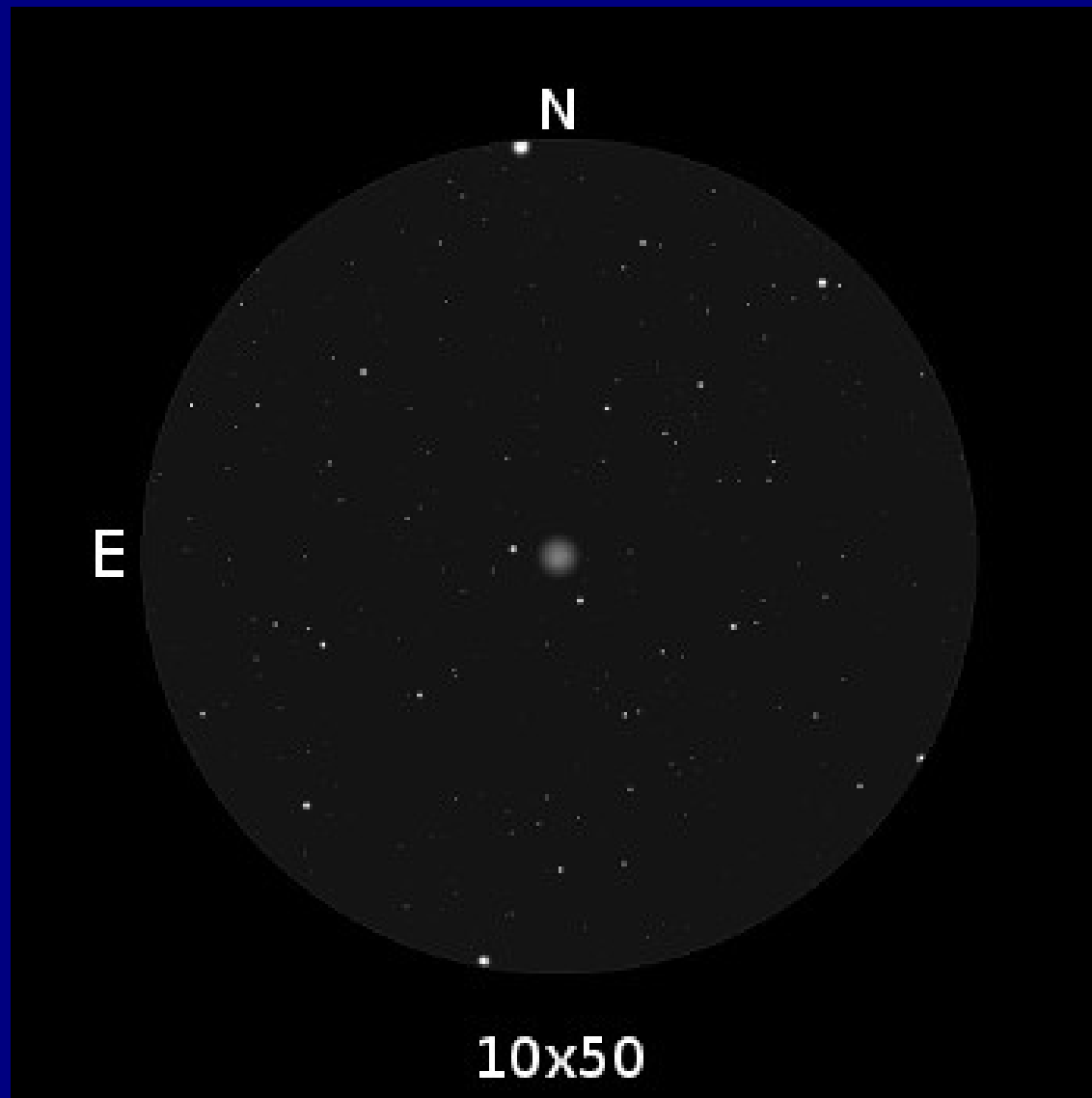
Large Faint Galaxy: M33



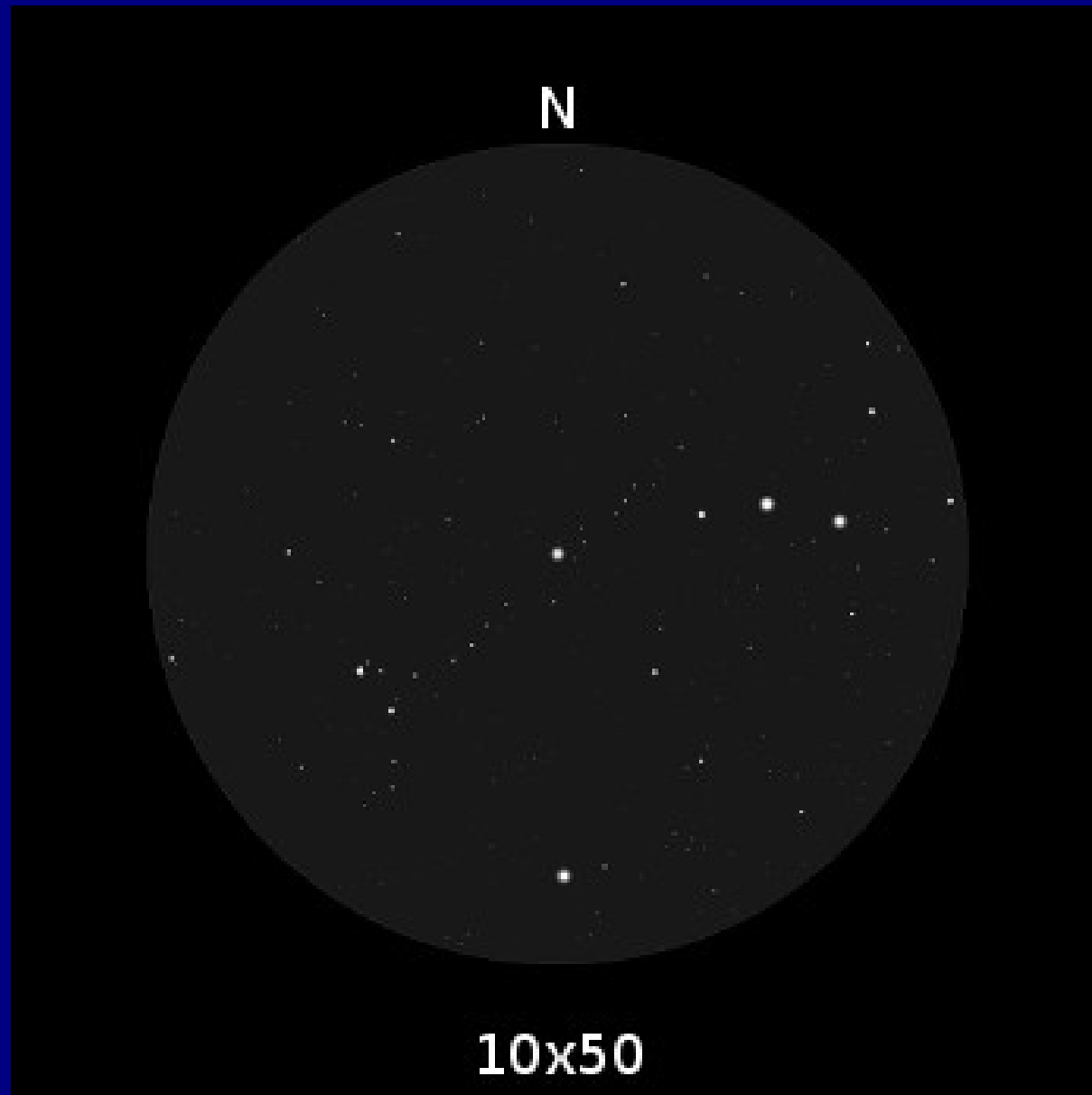
Planetary Nebula: M27



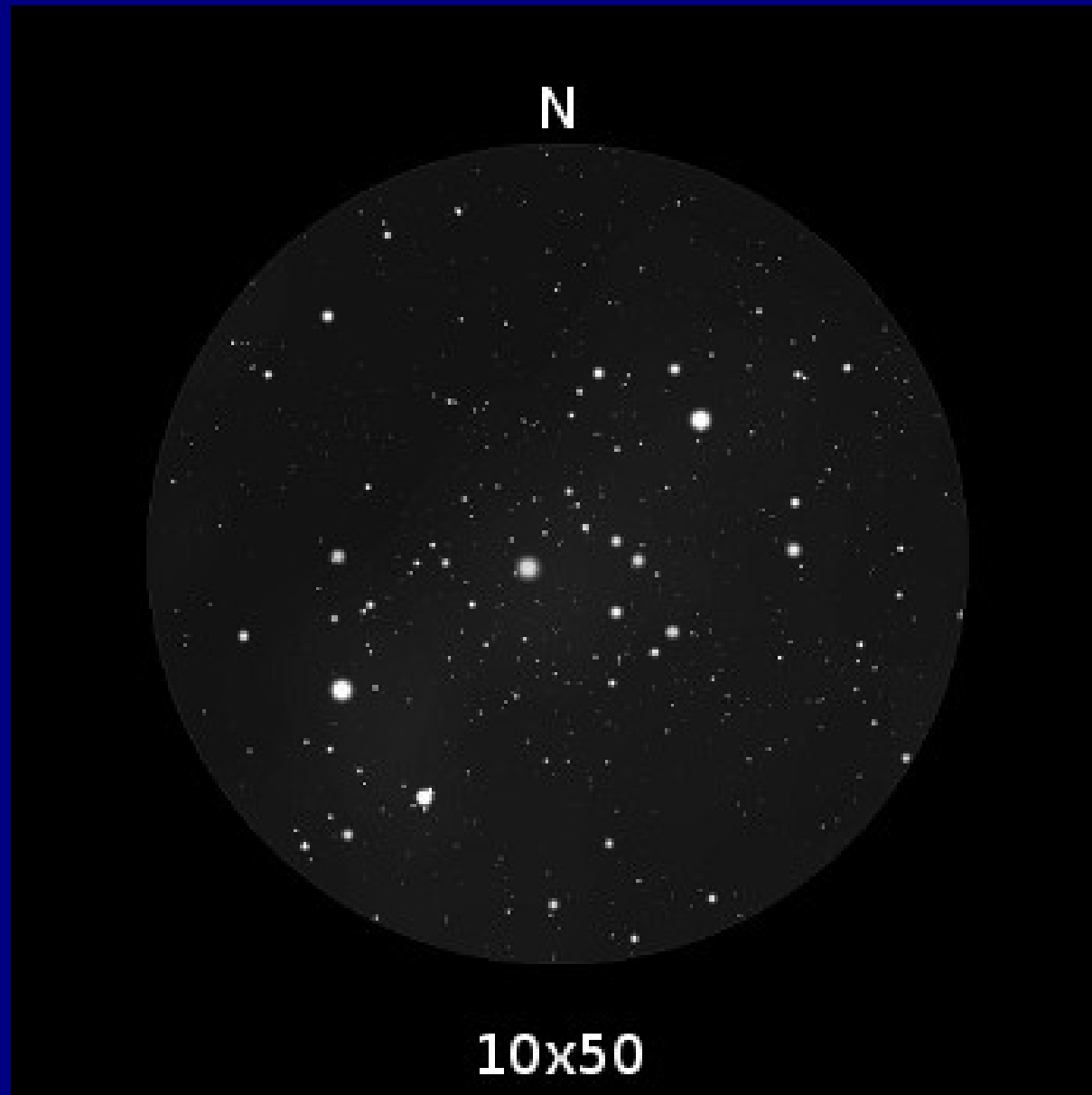
Globular Cluster: M13



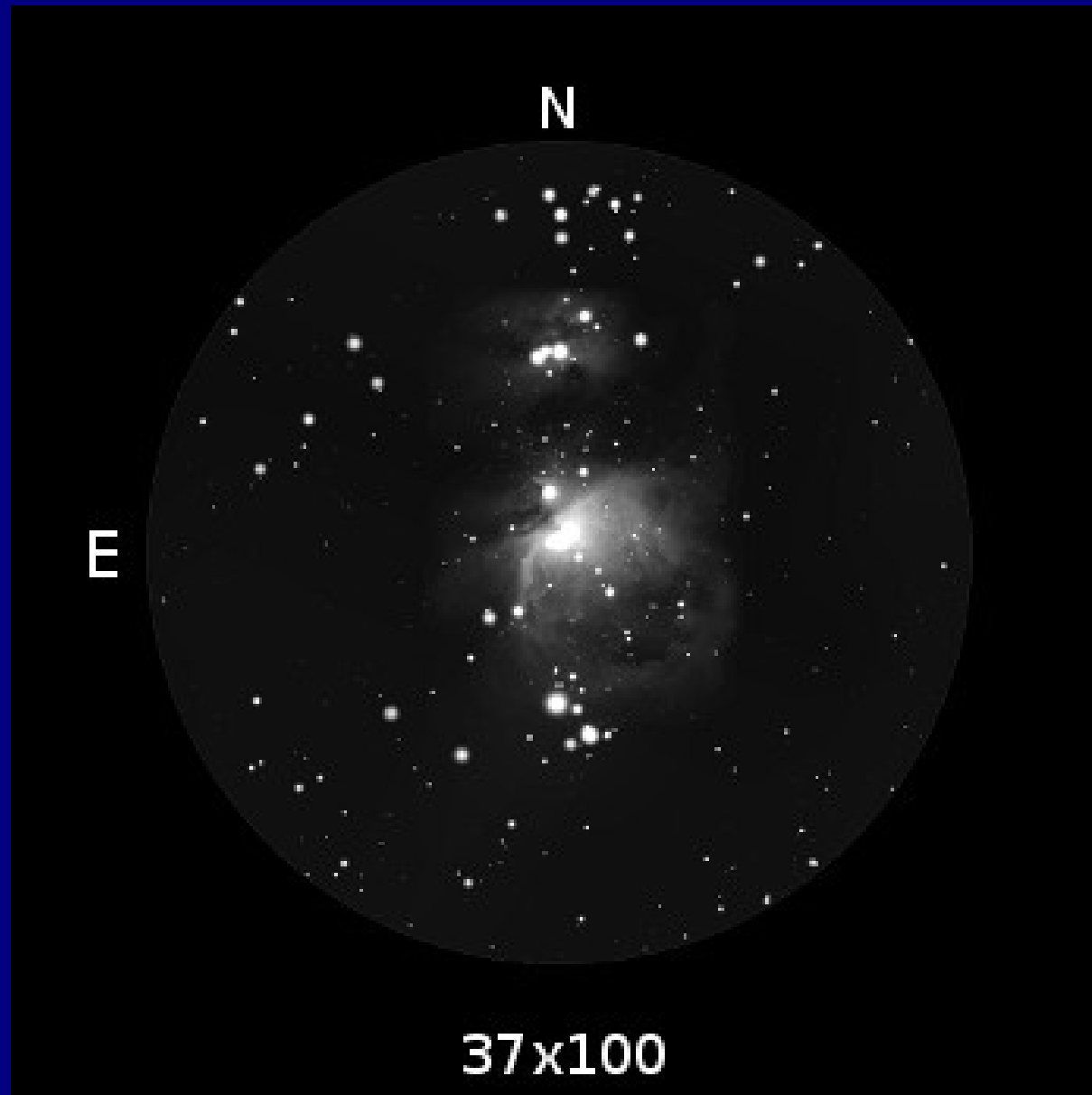
Asterism – Kemble's Cascade



Open Cluster - Cr70



Emission Nebula: M42



Objects to Observe

<http://binocularsky.com>



The Binocular Sky

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Object Selection

Hover your pointer over any dotty-underlined words for further information.

Observer Criteria

Latitude: °

Horizon Altitude: °

Maximum Binocular Aperture: ☐ 50mm ☒ 70mm ☐ 100mm

Object Criteria

Object Type

*** ALL ***
Star
Asterism
Multiple Star
Variable Star
Galaxy
Globular Cluster
Open Cluster
Dark Nebula

Constellation

Carina
Cassiopeia
Centaurus
Cepheus
Cetus
Coma Berenices
Corona Australis
Corvus
Crux

Limiting Magnitude

5
6
7
8
9
10
11
12
13

Sort Criteria

Primary

Constellation
Magnitude
Object type
Right Ascension

Secondary

Constellation
Magnitude
Object type
Right Ascension

Tertiary

Constellation
Magnitude
Object type
Right Ascension



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Search Results

Your Latitude = **+53°**

Your Horizon Altitude = **25°**

Your Declination Limit = **-12°**

Stock 2 (the *Muscleman Cluster*) (oc; Mag: 4.4; Cas)

NGC 457 (the *ET Cluster*, the *Owl Cluster*) (oc; Mag: 6.4; Cas)

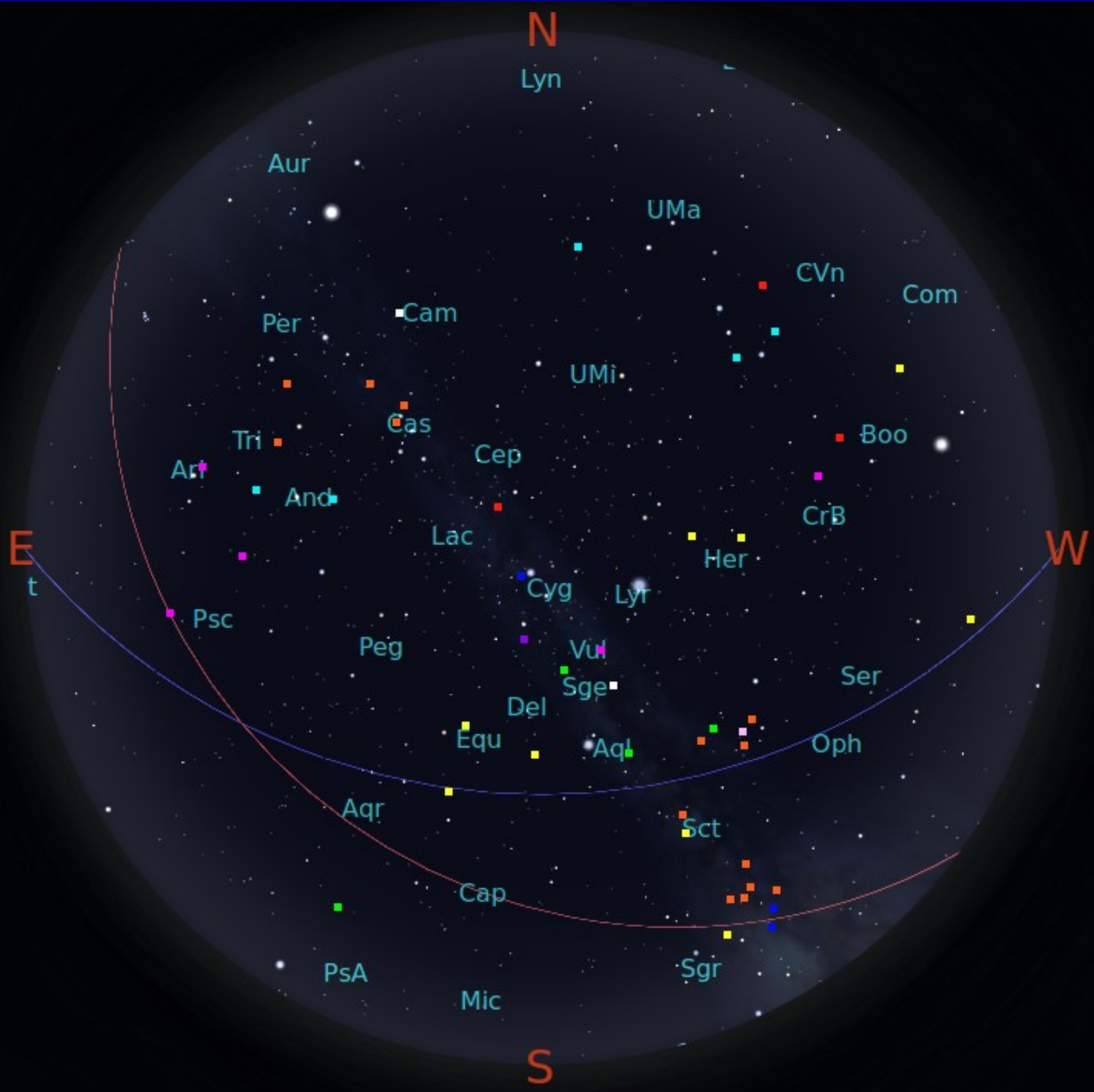
M52 (NGC7654) (oc; Mag: 6.9; Cas)

NGC 663 (oc; Mag: 7.1; Cas)

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6 8 7 5 4



Kemble's Cascade

Constellation: Cam

Object Type: Asterism

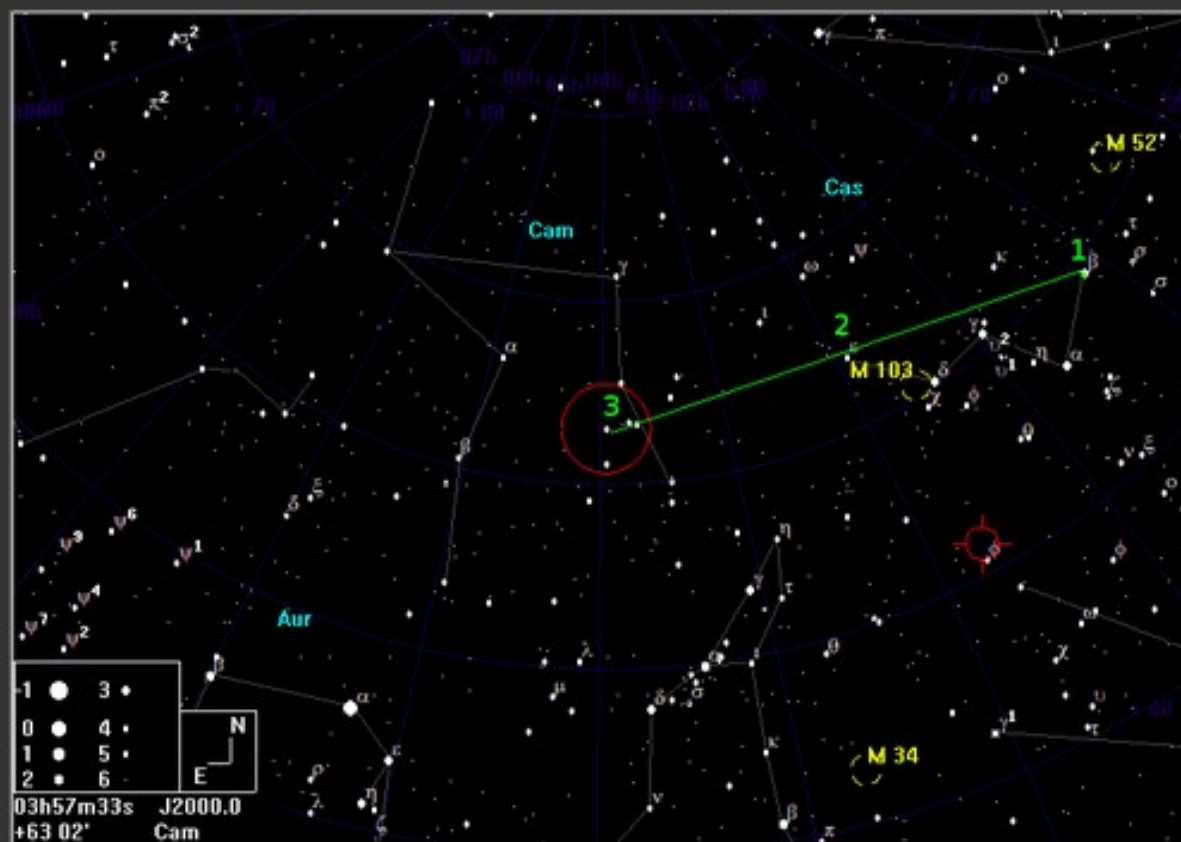
RA: 3h 57m 52s

Dec: +63° 7' 11"

Magnitude: 9.0

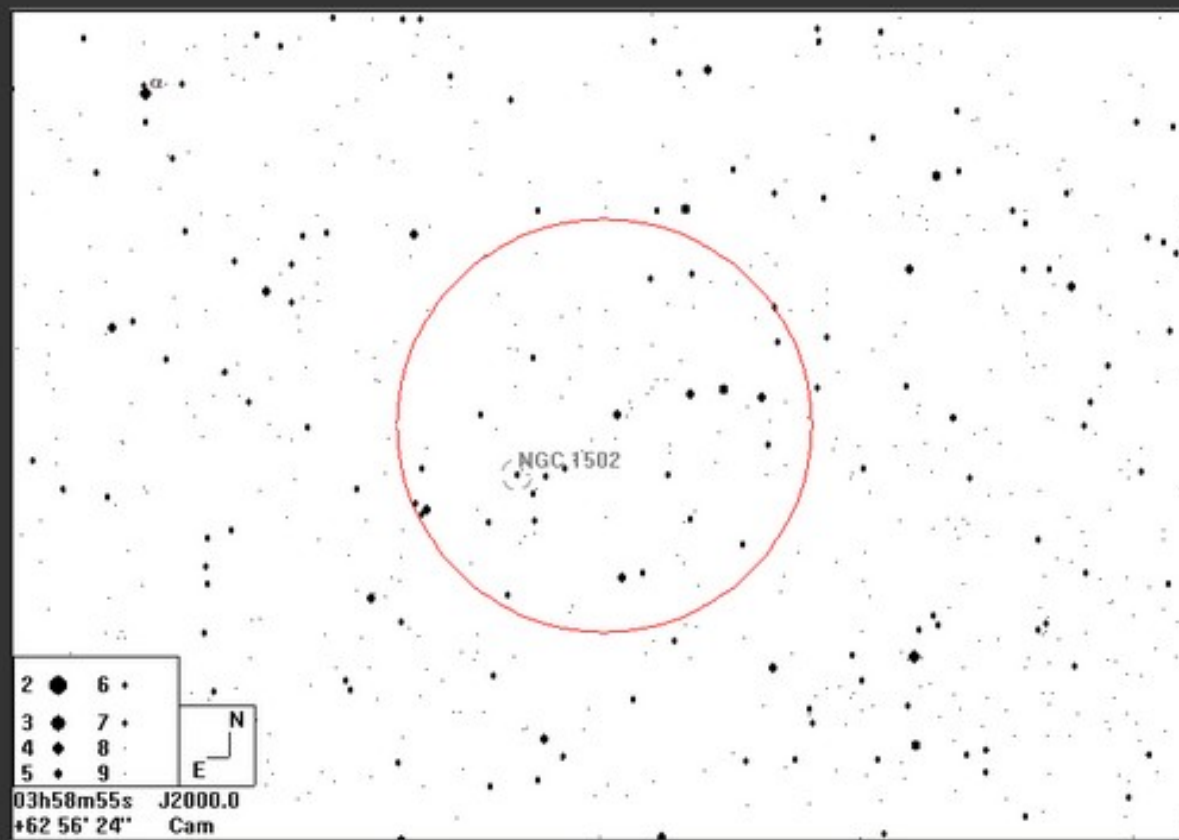
Recommended minimum aperture: 50mm

Charts for 50mm Binocular (5° aperture circle). Click on a chart to print it.



Location:

Kemble's Cascade lies in a region of sky that is sparse of bright stars. If you are confident of identifying the 4th magnitude α Camelopardalis in your skies, simply find the 5th mag star that is a little more than half a 5° field to the SW, then continue the same distance to the SW. If α Cam is not visible or identifiable, Take a line from β Cas (1) through ε Cas (2), and extend it the same distance (3) to the Cascade.



What You Should See:

This beautiful chain of stars, named for the late Canadian amateur astronomer, Fr Lucien Kemble, is one of the northern sky's finest sights in medium-sized binoculars. It is a ribbon of stars down to 9th magnitude, more than a dozen of which can be visible in 10×50 binoculars, that extends from NW to SE across a 5° field, with a brighter (5th mag) star near the middle and the small open cluster **NGC 1502** at the SE, which is the 'pool' into which the 'cascade' appears to 'fall'.

The magnitude given is for the fainter stars. The brightest star is magnitude 5 and **NGC1502** is magnitude 6.9, but you need to be able to see the fainter stars to appreciate the asterism.



