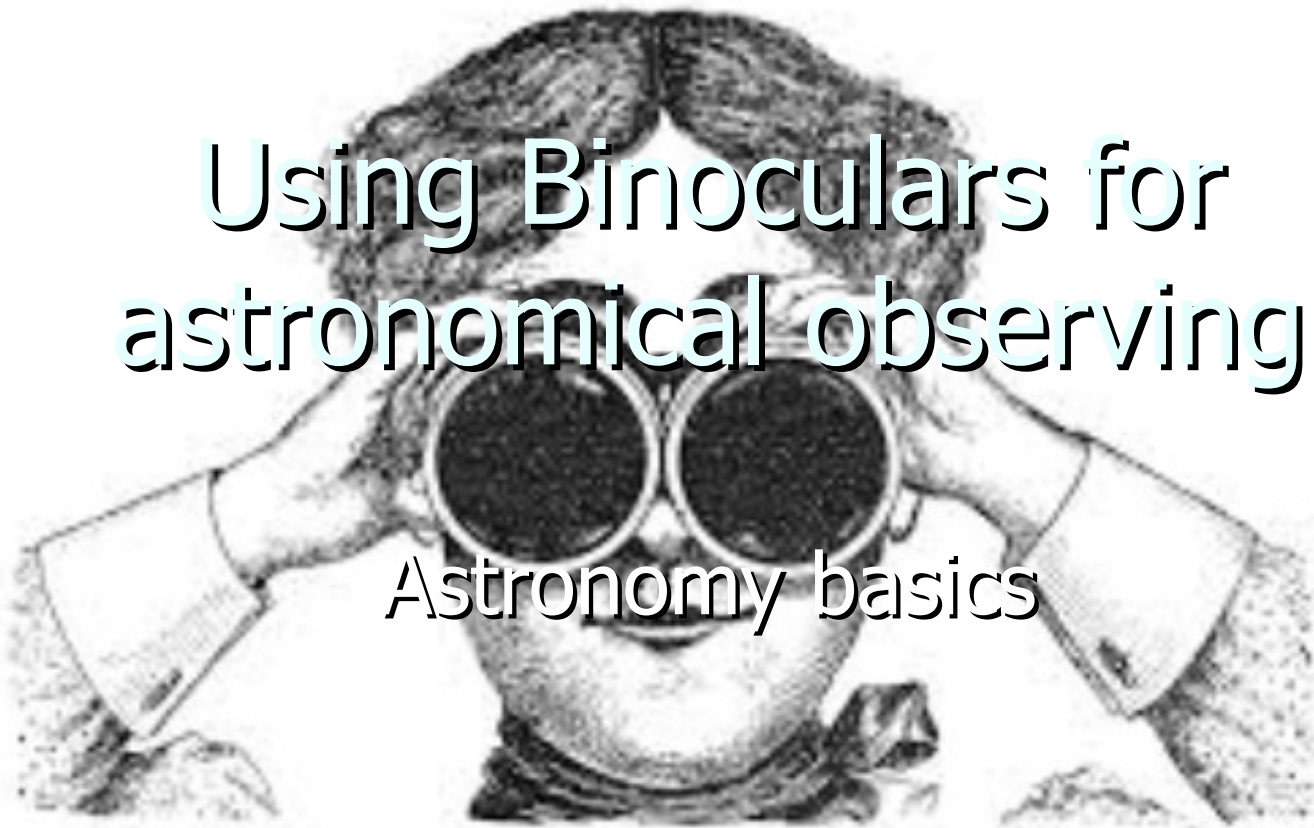


Using Binoculars for astronomical observing

Astronomy basics



Overview of session

- Choosing binoculars
- How they work
- Adjusting and maintaining
- Holding and supporting
- Uses

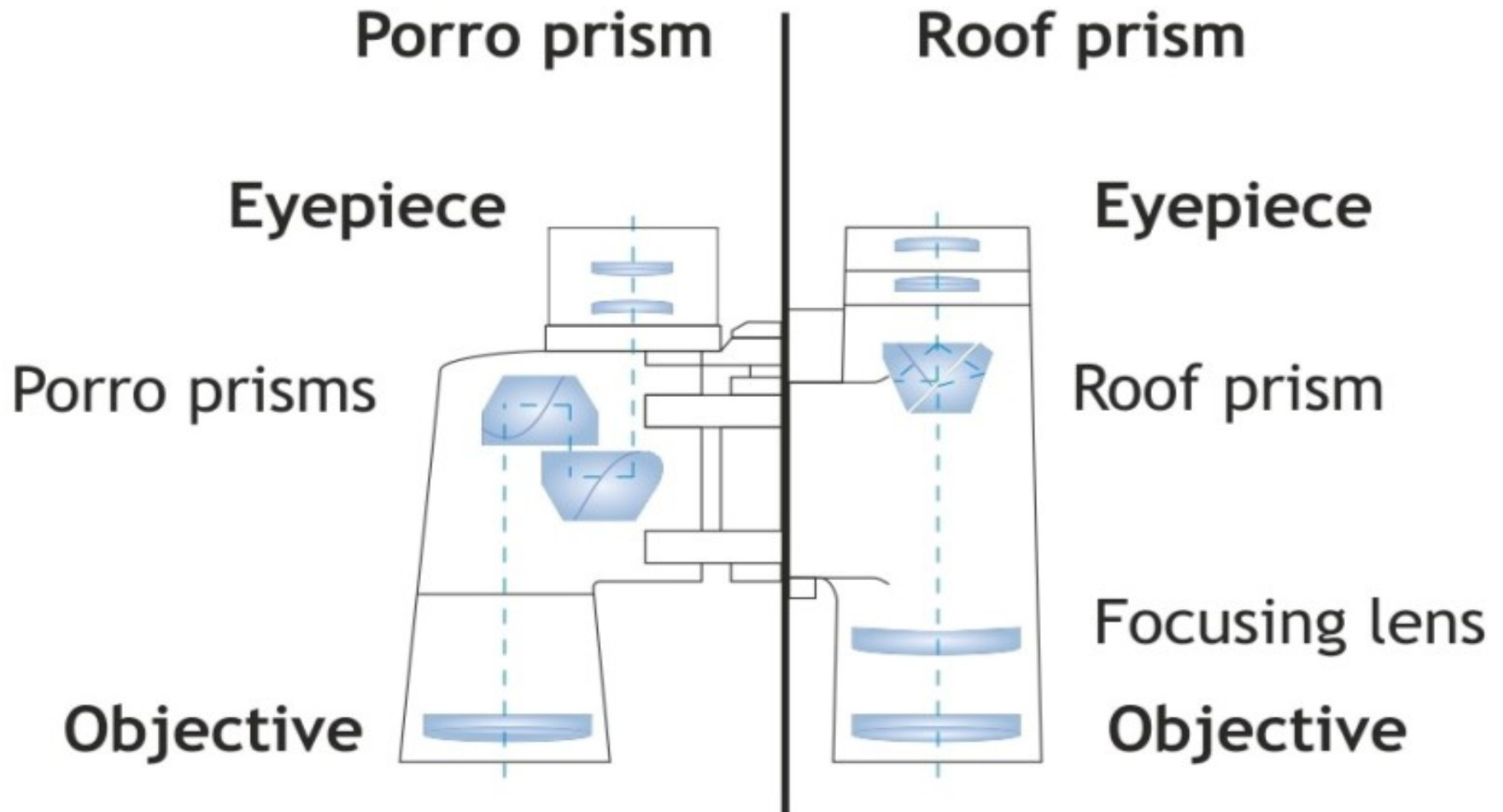
What are binoculars

- Essentially two low power parallel telescopes on the same mount
- Usually have some arrangement of prisms to make the instrument more compact while retaining the required light path length
- Usually of fixed magnification but zooms available and changeable eyepieces

Specification for astro use

- Look for “Porro Prism” not “Roof Prism”
- Quality binoculars will use BK7 glass prisms
- Should be waterproof
- The larger binoculars are nice to have but hard to hold, 50mm objective is good. 30mm a bit too small
- Magnification – try to stick to $\frac{1}{4}$ of the objective diameter or less – for 50mm 10x mag is good
- Probably best to avoid zoom eyepieces

What's inside?



Porro prism binoculars



Roof prism



What the numbers mean



16 x 50

The magnification is 16 times and the diameter of the large lens at the front (the objective lens) is 50 mm.

183 FT/1000 YDS

If you are looking at something 1000 yards away the width of the image will appear to be 183 feet wide (3.5 degrees)

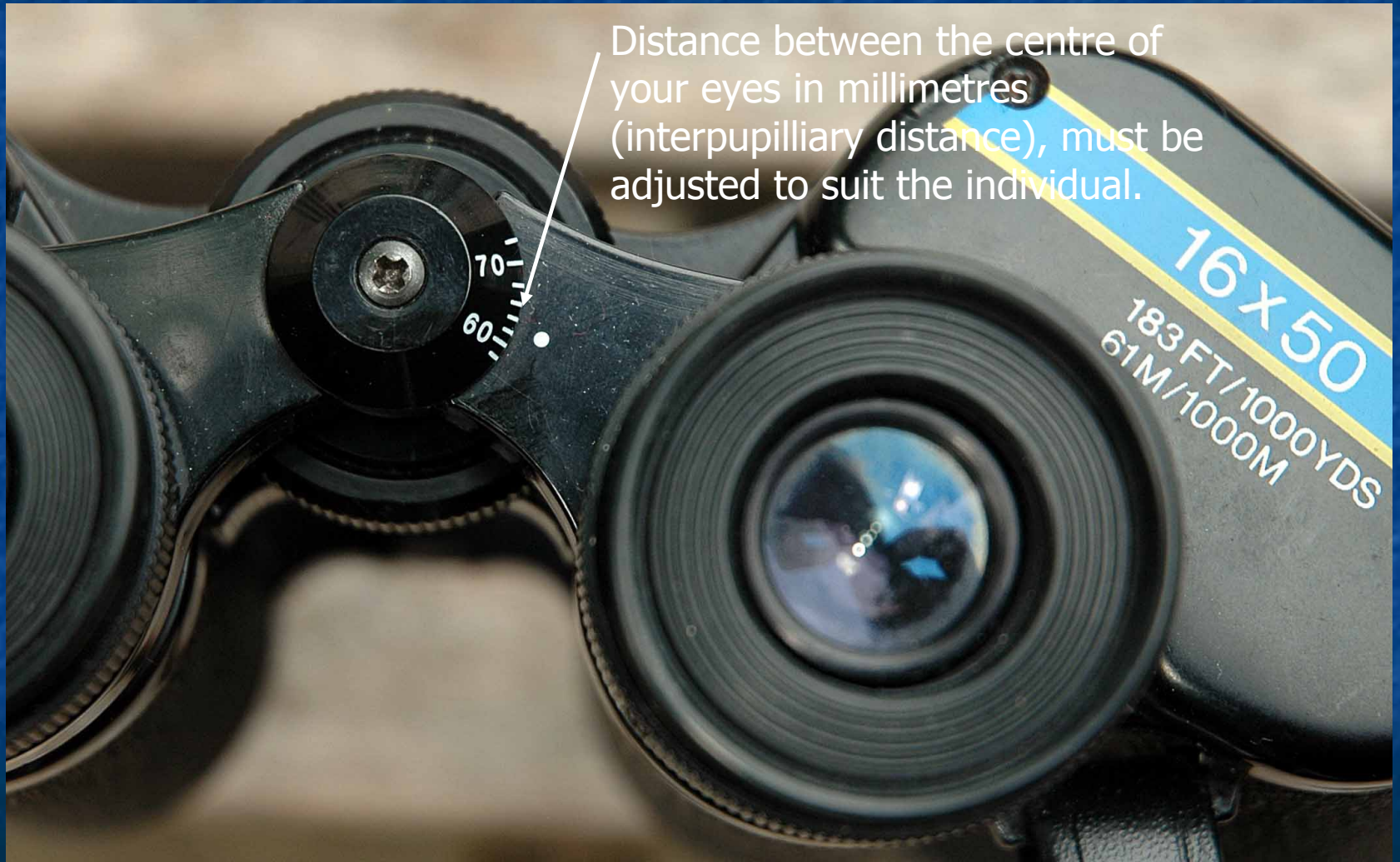


10 x 50

Field 5°

HIGHEST QUALITY

Adjusting to fit



Distance between the centre of your eyes in millimetres (interpupillary distance), must be adjusted to suit the individual.

Focusing for each eye

- Each eye is usually slightly different
- Binocular eyepieces can be adjusted separately
- Find an object and use the focuser to get a sharp image in the left eye
- Adjust the right eyepiece to also get a sharp image without touching the focuser (rotate the eyepiece)



Problems

- If the images in each eye do not seem aligned you may have a collimation problem
- With a new purchase – return them
- Not usually adjustable by the user – may need expert attention
- Slight misalignment quite common, can be used but may cause eyestrain



Supporting binoculars

- Essential to support correctly to avoid shaking of the image and fatigue of the arms.
- Larger binoculars are best on some kind of mount or tripod, smaller binoculars can be hand held

Resting elbows

- Elbows resting on chair or a low wall
- Triangles give stability and take the weight



Resting elbows





Using an upturned broom!

- Adds stability whilst allowing freedom to move
- Works surprisingly well



Using a tripod

- Basic photo tripod
- Works well
- Not as easy to move around as hand held
- Can get tripod adaptors (about £5)





Parallelogram mount



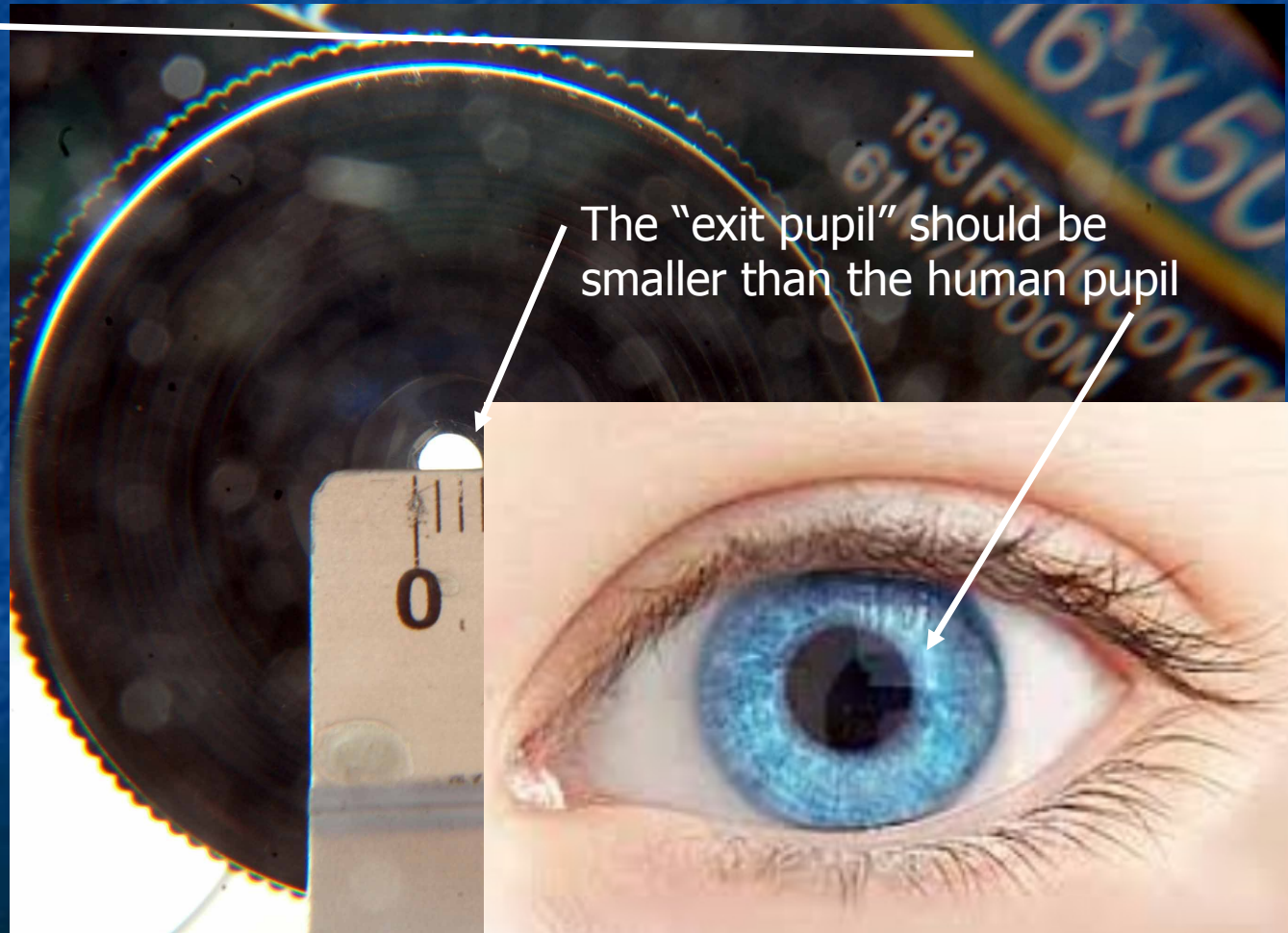
A bit about magnification

- A ratio of the diameter of the front lens to the magnification of 5:1 is a good average
- Can be less but avoid more e.g. $8 \times 50 = 6$
- Too high a magnification, say 16x, and the instrument is more difficult to use
- After 20x get a telescope!
- x8 and x10 are very good



A bit more about magnification

- $50/16=3.1$
- This is the size of the circle of light coming from the eyepiece
- Your pupil will be less than 7mm across
- The magnification and aperture size will be matched for this purpose



Aiming your binoculars

- Much easier with lower magnification x8 say, difficult with x16
- Acquired skill that is not difficult to learn
 1. Look at the object or point in the sky that you want to observe
 2. While still looking at the object move the binoculars up to your eyes
 3. Enjoy the view
- Practice makes perfect! Look for satellites and planes
- Hunting the sky when the Sun is up is dangerous

Tip – putting the binoculars to your eyes then hunting for objects never works

What can I look at?

- Things that are big in the sky
- Things that are relatively bright
- Things that move around

What can I look at?

- The Milky way
 - It's big
 - It's bright
 - You will be able to see beautiful star fields, open clusters, nebulae and double stars
 - Best in mid summer or the dead of winter
 - Good to practise on and an easy target

Star clusters

- Star clusters
 - Often too big for a telescope
 - All the following are stunning in binoculars
 - M45, the Pleiades, Winter
 - M44, the Beehive cluster aka Praesepe, Spring
 - The Double Cluster, Perseus, NGC869 and NGC884, anytime – circumpolar
 - Brocchi's cluster in Vulpecula, Summer
 - M36, M37, M38, all in Auriga, late Winter, Spring
 - The Hyades in Taurus - Winter

Galaxies

- Some close galaxies are big and bright and do not work well with telescopes, binoculars often the answer
 - M31 Andromeda, a must see object, even low power binoculars struggle to cover its 3.5 degree width, most of the year
 - M33 Triangulum galaxy, over a degree across, easier in binoculars than a telescope, late Summer

Planets

- Very bright but also very small
 - Jupiter – will see 4 moons easily and be able to watch them move, maybe some surface cloud details (stripes)
 - Saturn – will see its disc and rings
 - Mars – small orange/red disk
 - Uranus – starlike
 - Neptune – ok so this is probably out of reach

The Moon

- Reasonable big $\frac{1}{2}$ degree across look for:
 - Wonderful views of the Mare
 - Many of the larger craters and mountain chains
 - Earthshine
 - Eclipses

Other deepsky objects

- Globular clusters and nebulae are fair game:
 - M13 and M92 – globulars in Hercules, easily visible in binoculars, Summer
 - North American Nebula, Cygnus, Summer
 - Great Orion Nebula, M42 – amazing, winter
 - I have seen the Veil nebula in binoculars – but it takes a lot of practice and a very dark sky
 - Double stars – Albireo in Cygnus works well, also Mizer and Alcor in Ursa Major

Comets

- Binoculars are superb for comet hunting.
 - You need to find out what comets are about and approximately where they are, anything with a magnitude brighter than about 9 should be possible.

Details of constellations

- Many constellations have hidden wonders shown up with binoculars:
 - Dephinus – small but lovely
 - Hyades – an open cluster with visible doubles
 - Auriga – with its open clusters
 - Cassiopeia – lovely star clusters
 - Cygnus - wonderful rich star fields and nebulae