Beginners and Back to Basics

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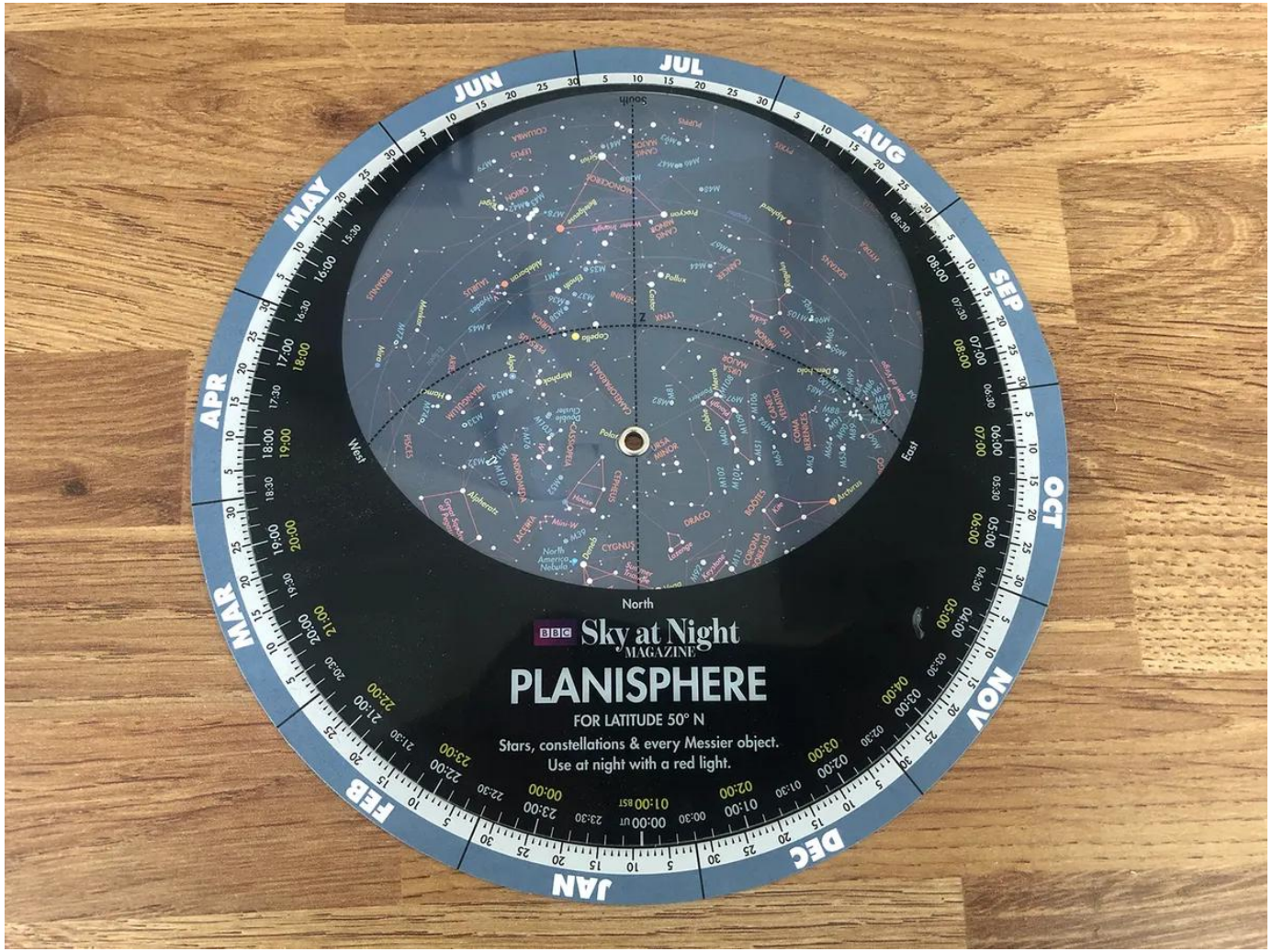
Get to Know the Sky

- Don’t try to learn every constellation, but….
- Learn some of the major ones and how they relate to each other:
- A good star map, planisphere or an App like Stellarium is best.
- Ursa Major (Plough) and finding Polaris: This is a must!
- Plough to Cassiopeia: On to Perseus and the Double Cluster
- Plough to Arcturus
- Pegasus and Andromeda (with M31 galaxy)
- Orion, Sirius and Taurus
- Cygnus, Lyra and the Summer triangle

Finding Your Way Around

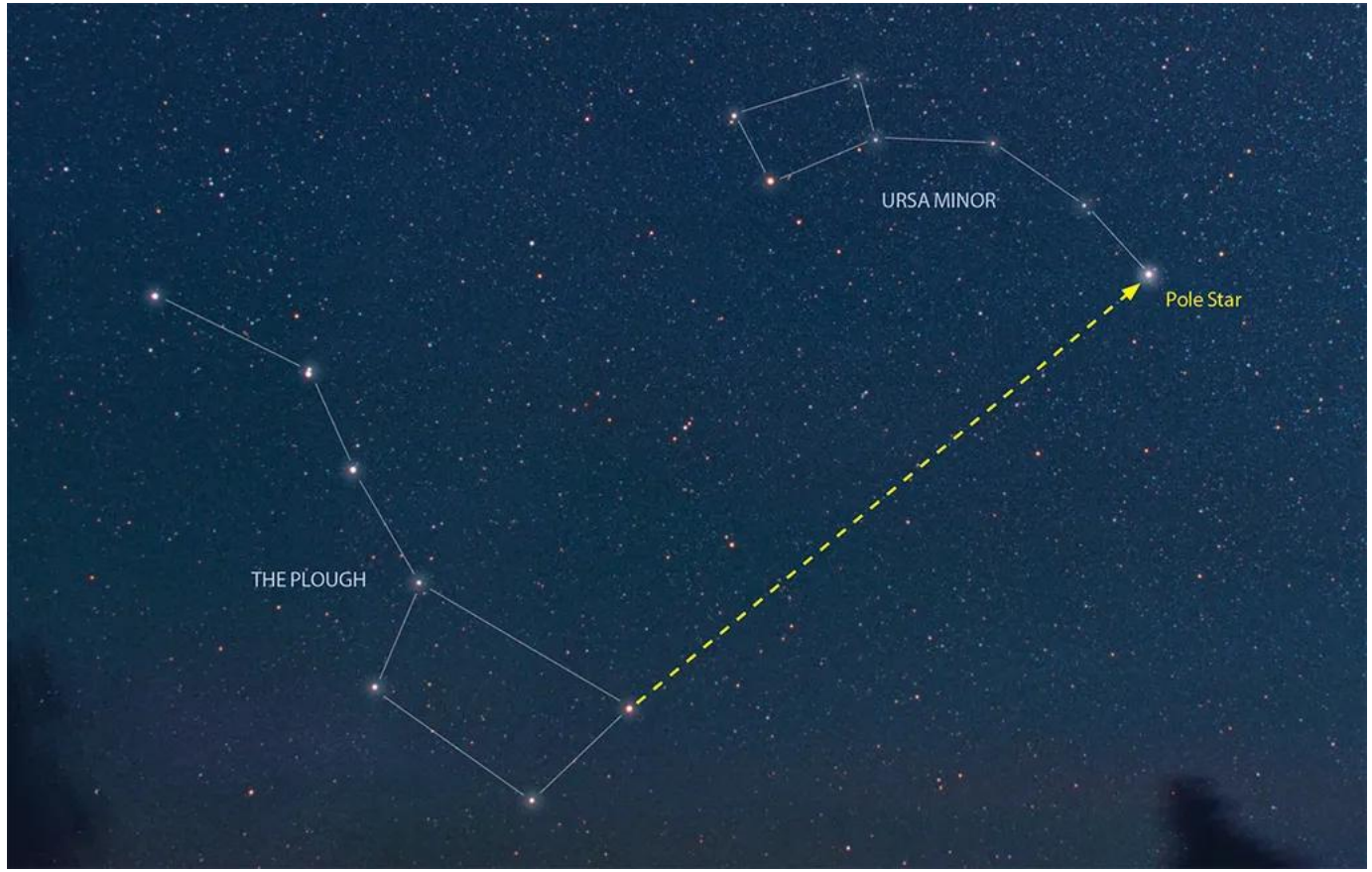


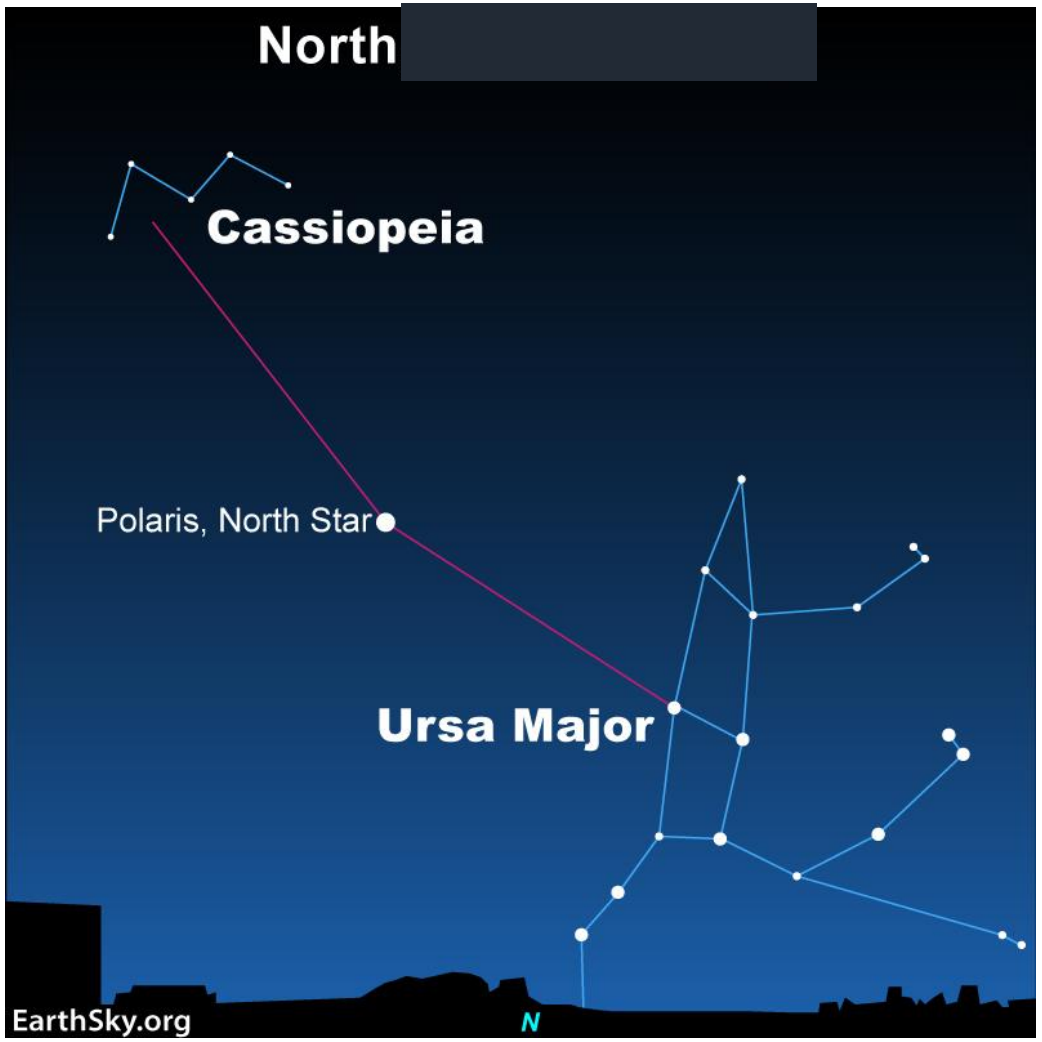
Apps: There are plenty of these free. I recommend Stellarium.

Planisphere. Cheap to buy online and very useful. Several makes available

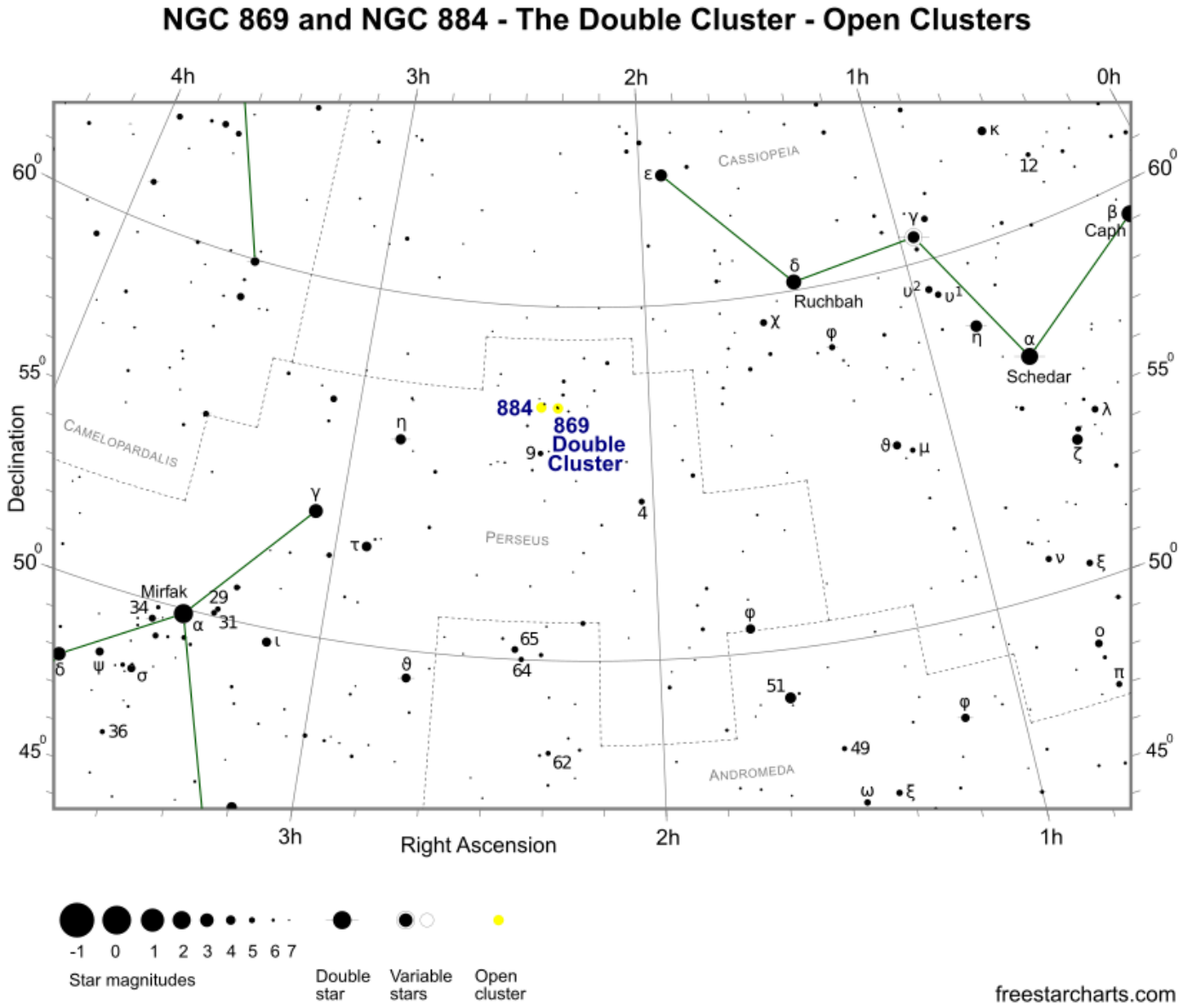
Set the time (UTC not BST) against the relevant date and it shows you what's in the sky at a glance.

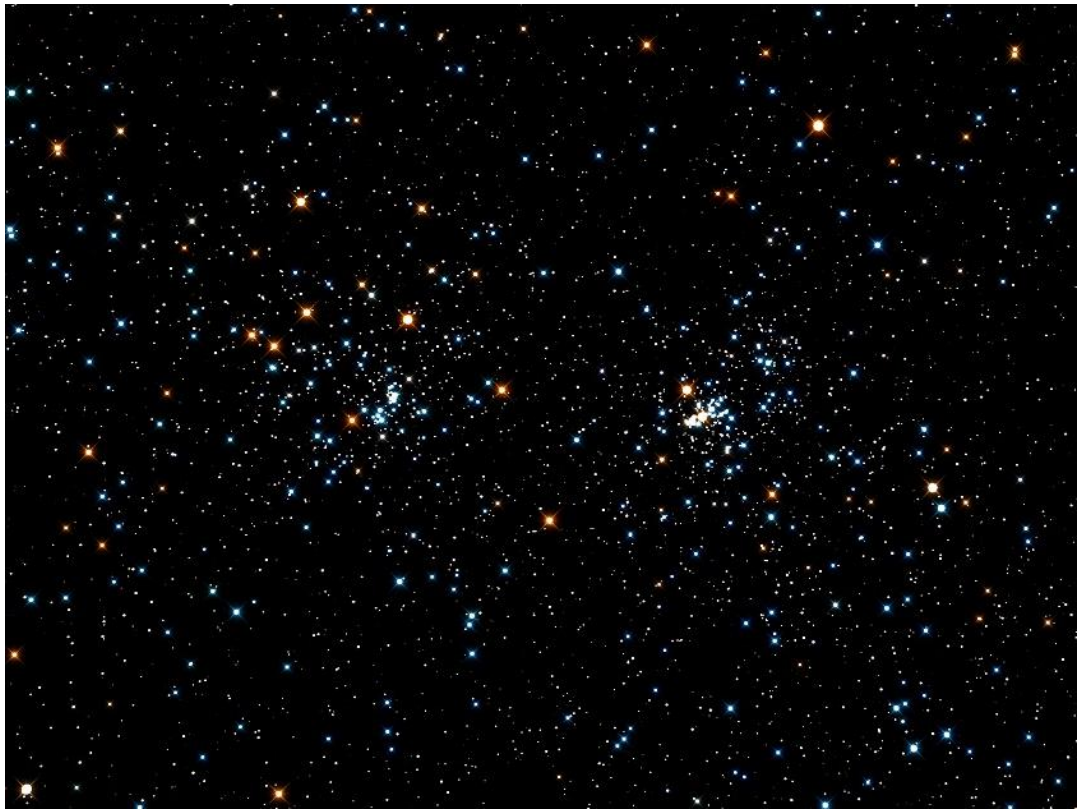
Getting to Know the Sky



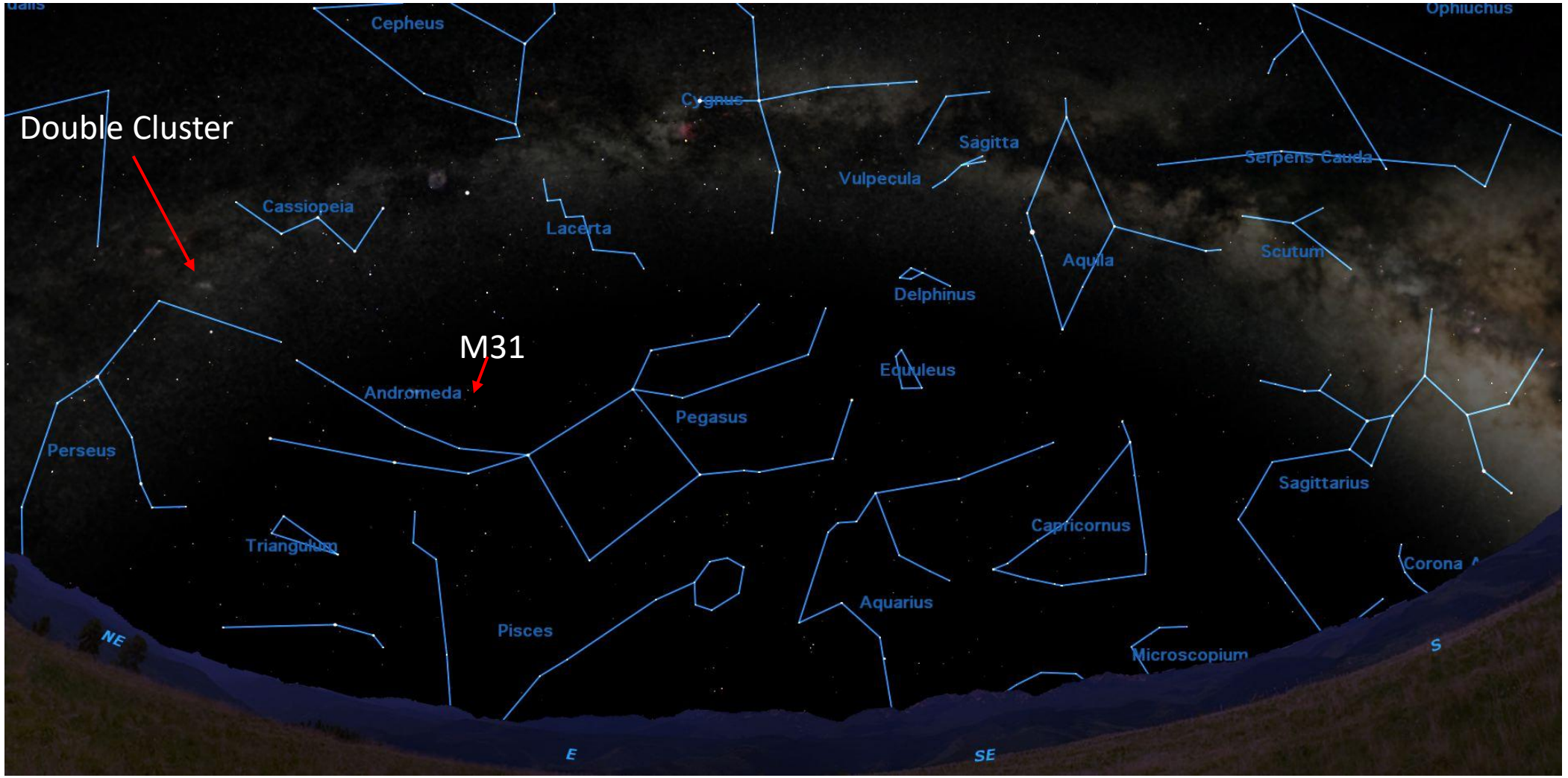


Perseus and the Double Cluster

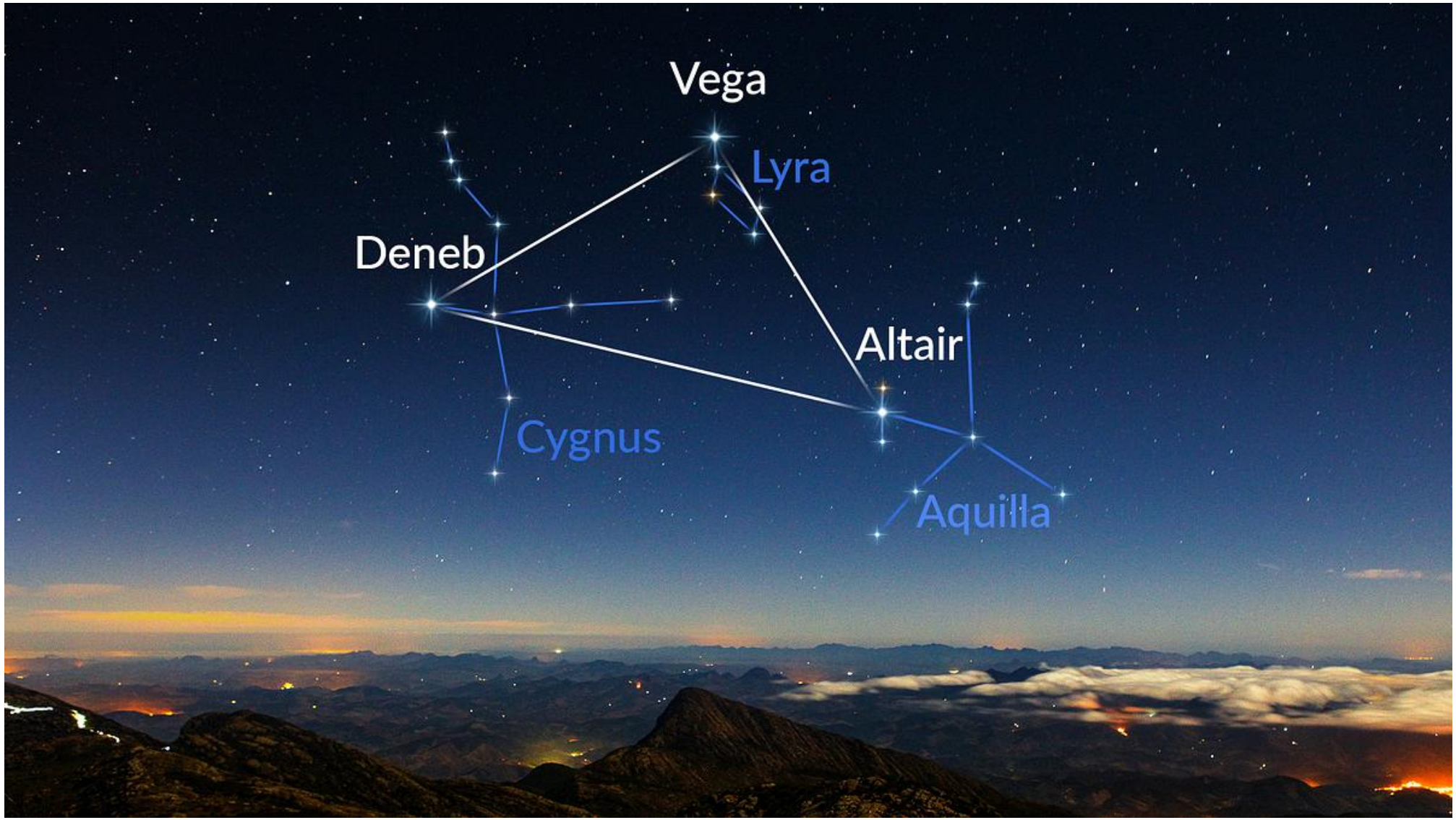




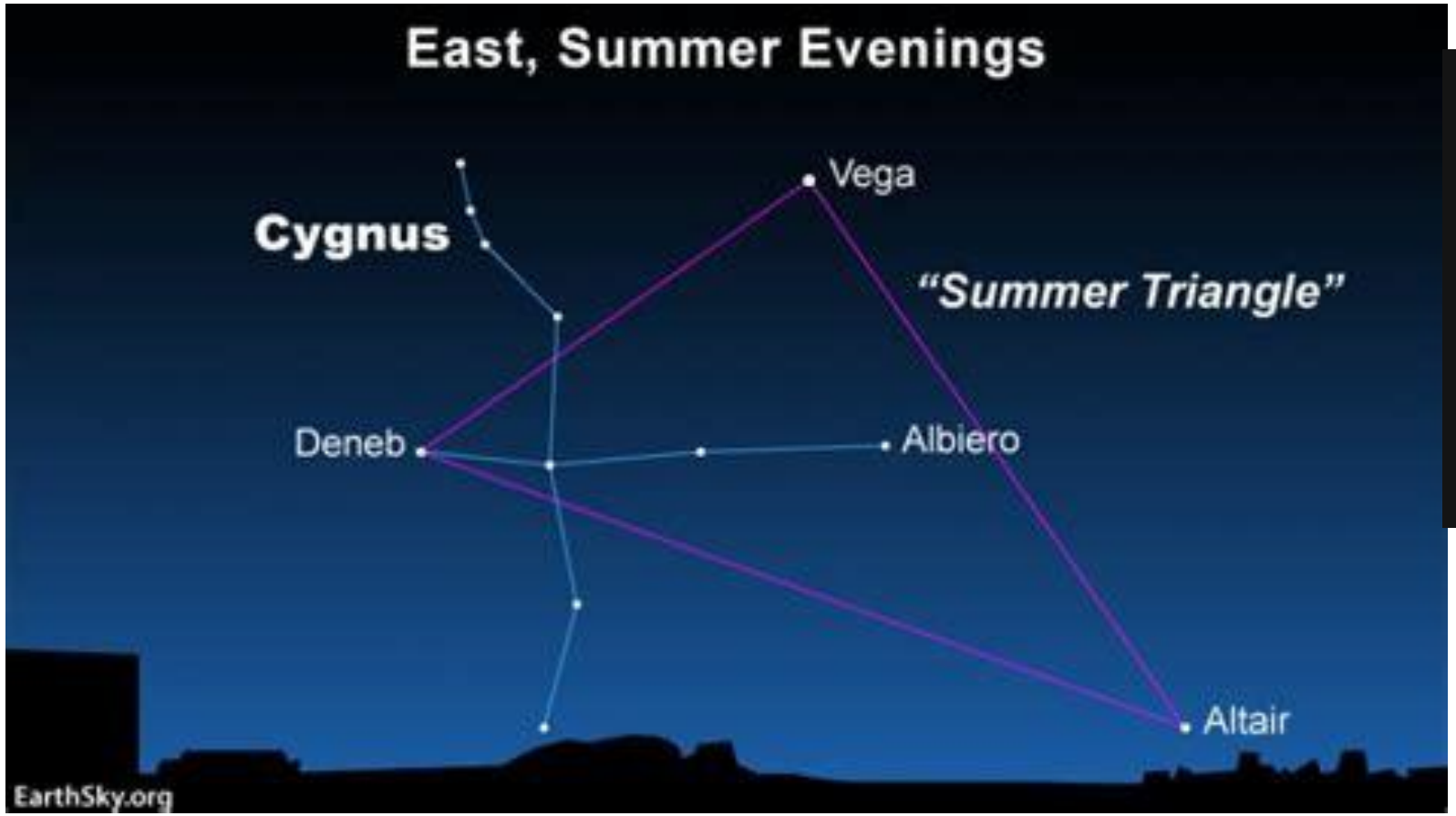
Summer Constellations



Summer Triangle

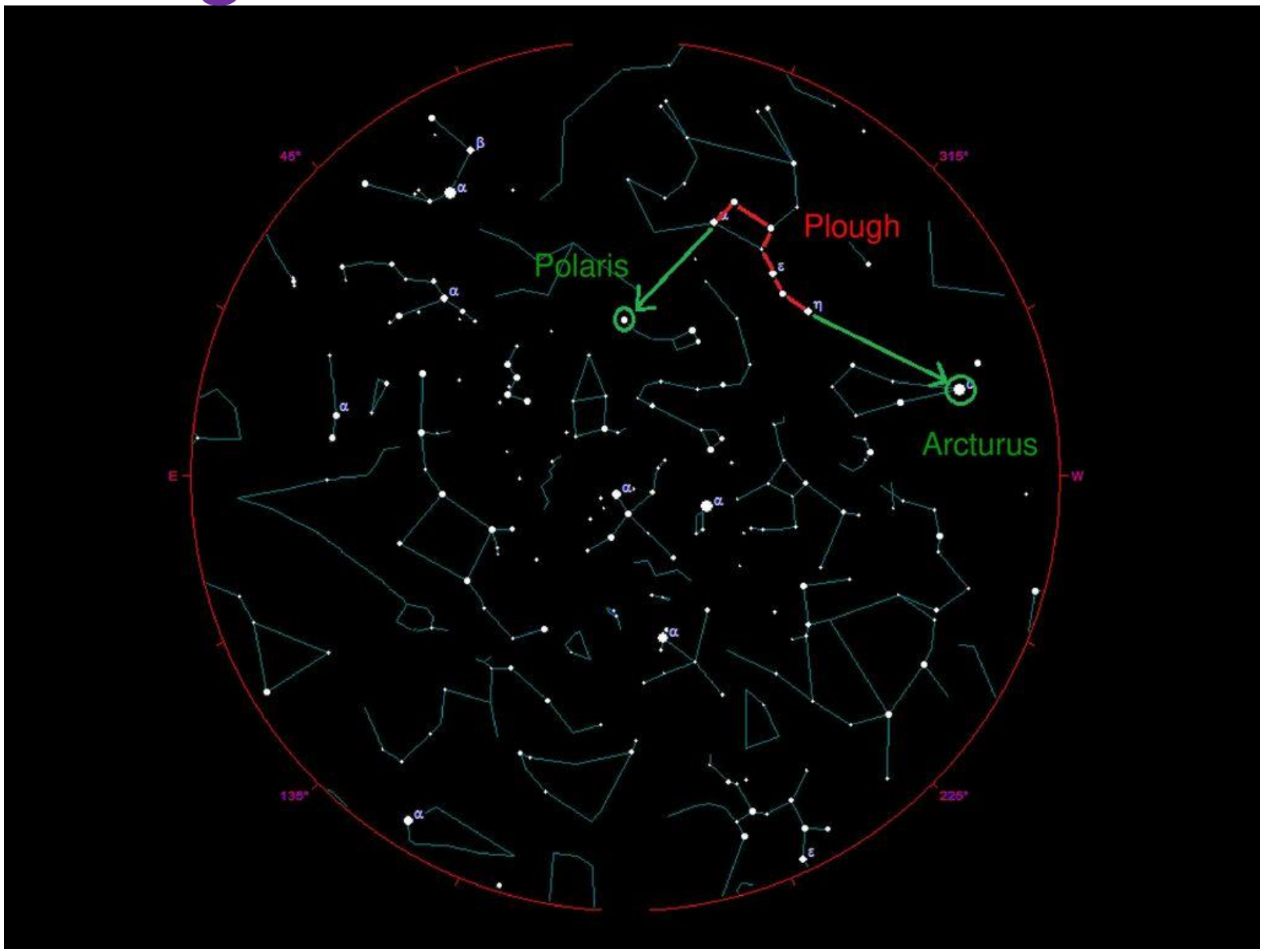


Cygnus, Vega and Albireo

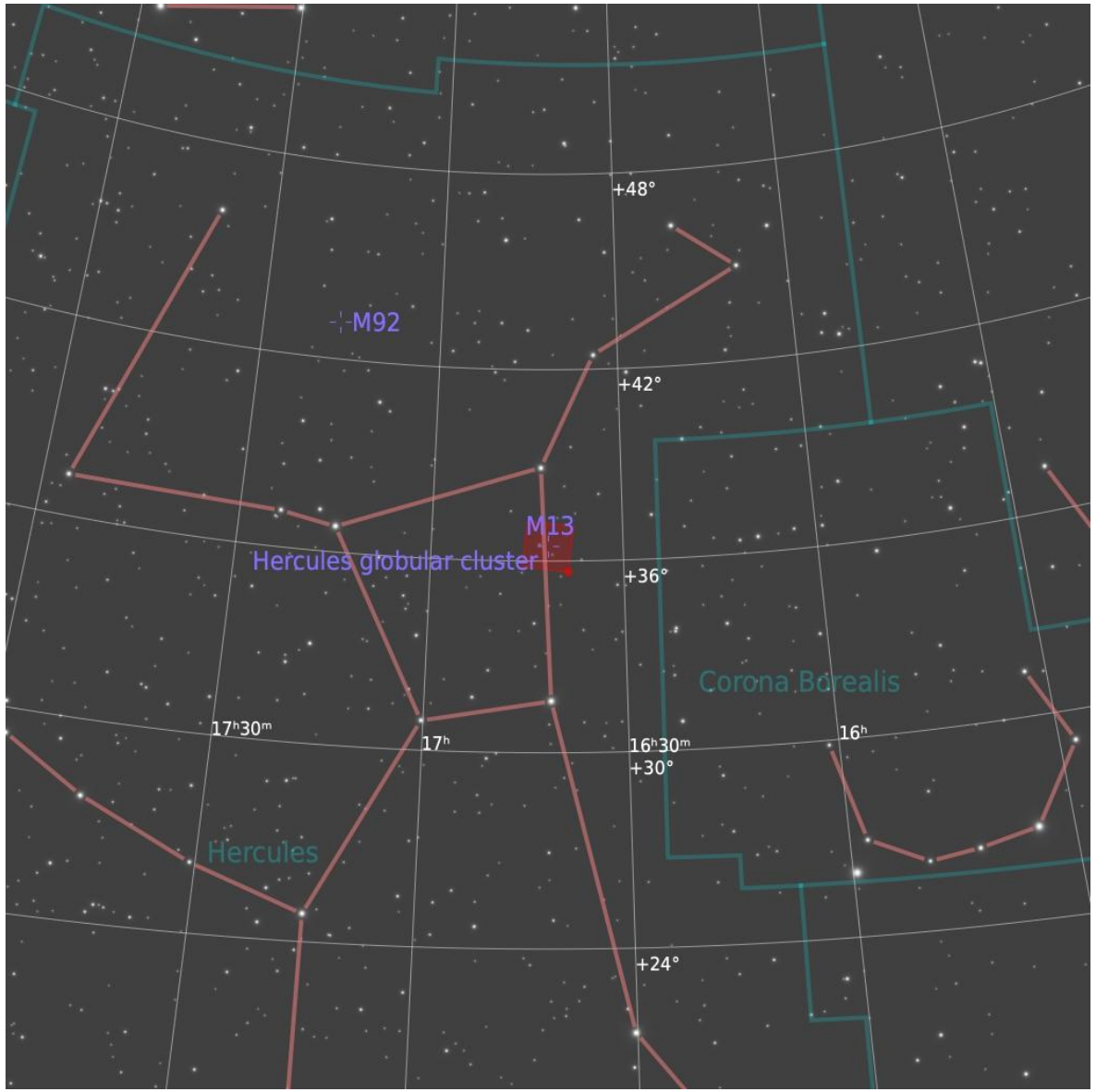


Albireo: Beautiful double star

Plough to Arcturus and Hercules

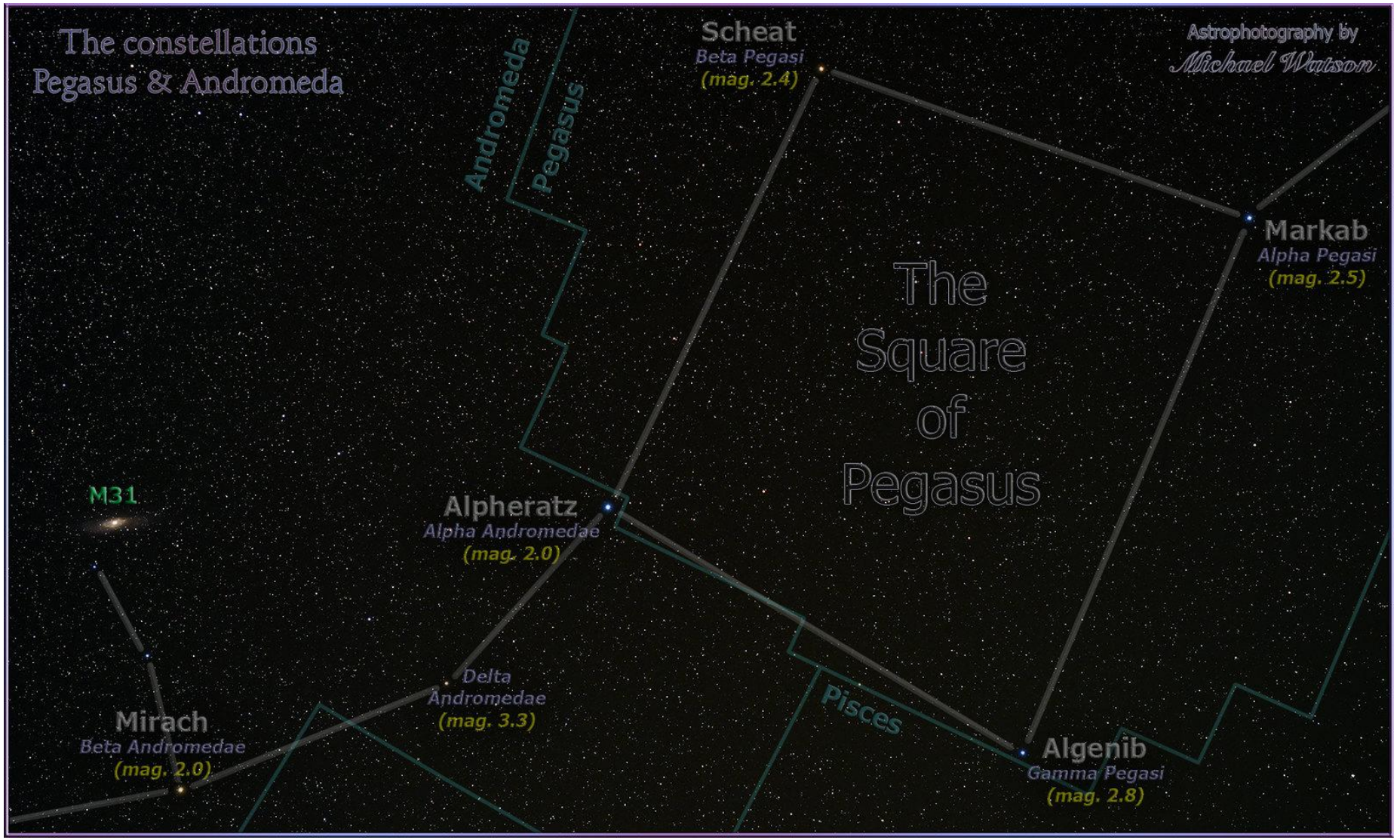


Hercules and M13 Globular Cluster



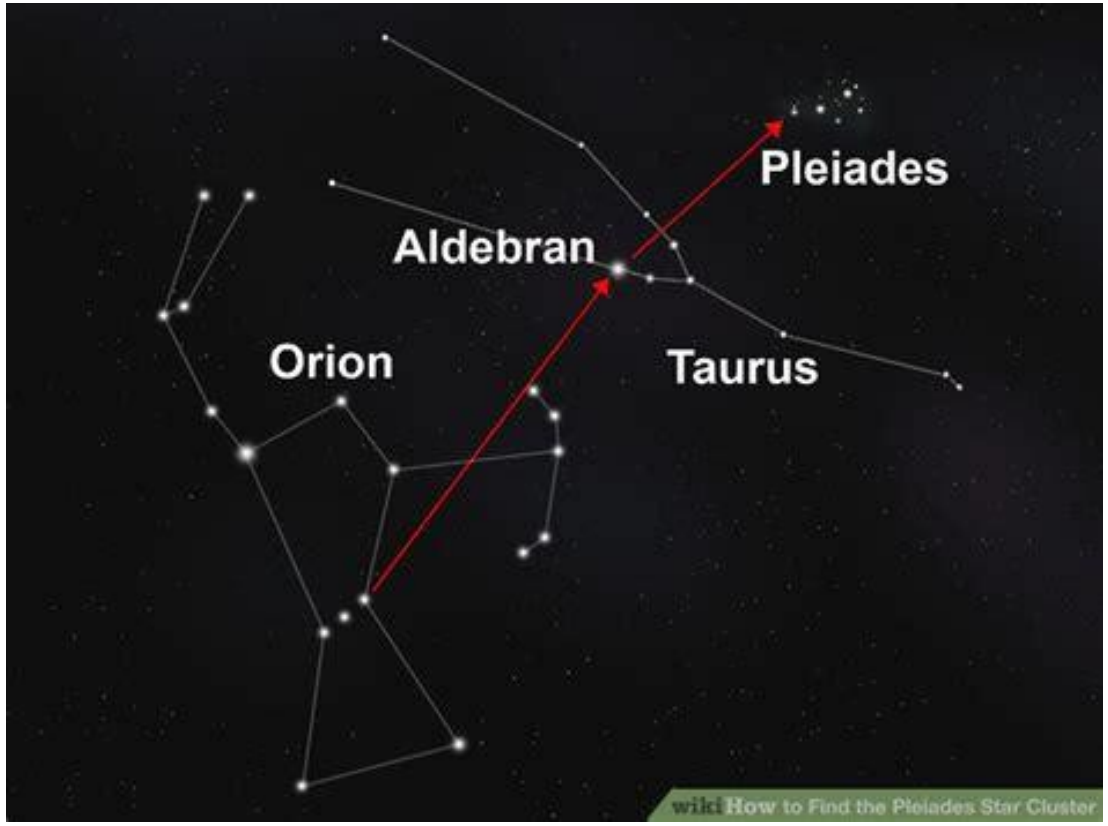
M13 Globular Cluster

Square of Pegasus with Andromeda



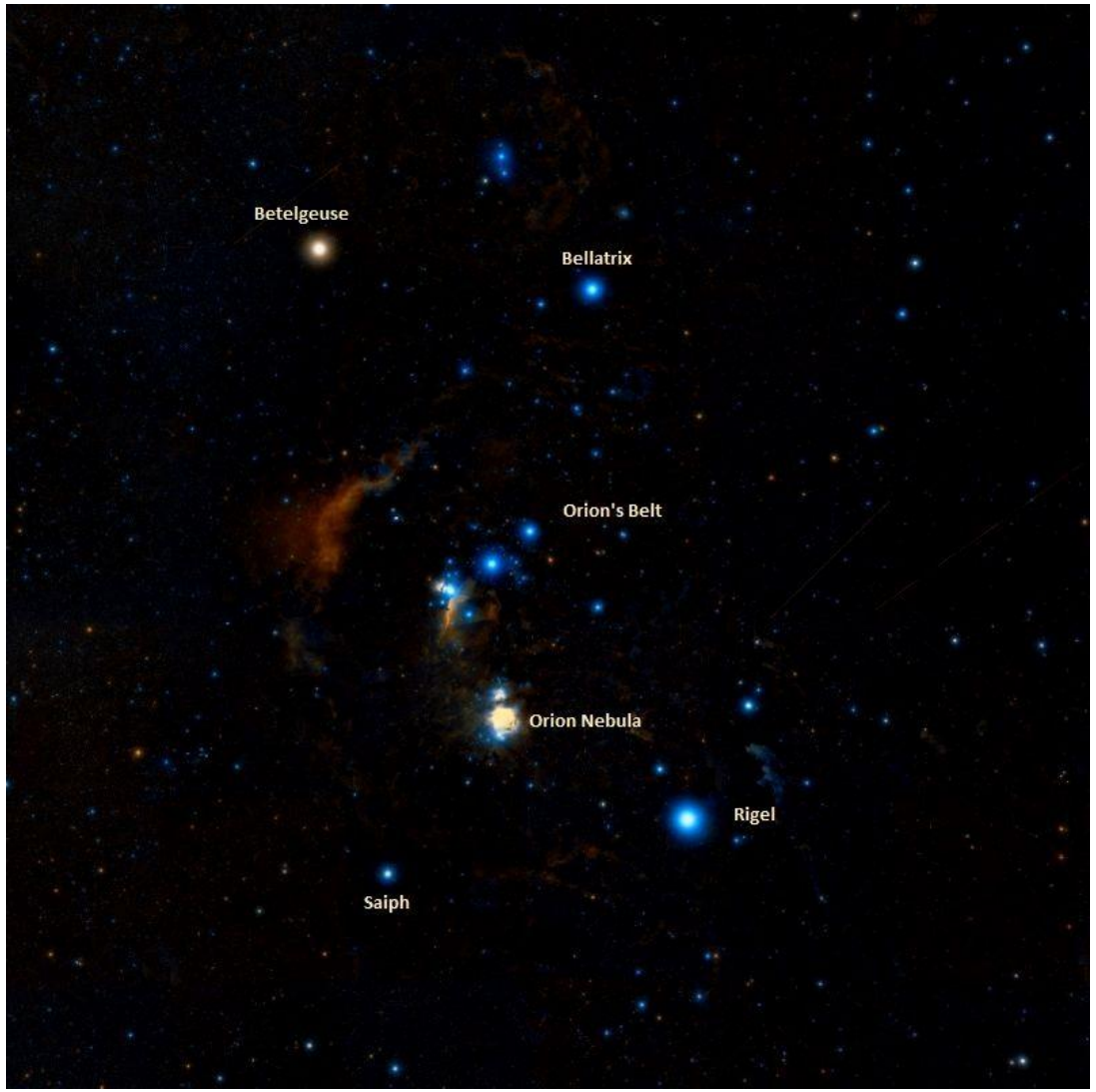
Winter Sky: Orion and Sirius

Orion, Taurus and The Pleiades



Don’t expect to see the nebulosity. It needs long exposure photography to show up.

Winter Sky: Orion Nebula



The nebula is the ‘middle star’ of the sword below Orion’s belt. Easily seen with binoculars.
Don’t expect to see colour with the naked eye through a small telescope.
A 10 or 15 second exposure will bring out some colour though. Use a high ISO (eg 1600 or 3200)

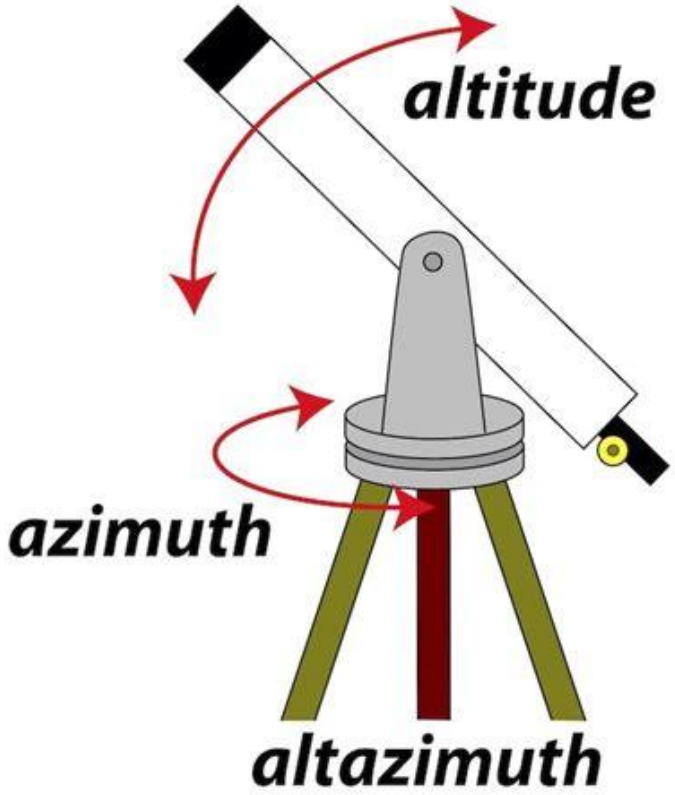
Equipment for a Beginner

- A good pair of binoculars is a must to start with.
- Find objects like the Double Cluster. Orion nebula. Try to find a dark sky site for the best views.
- The Moon: Up to around 75% is best. Craters will have shadows and be easy to see. Plato, Copernicus, Tycho are just a few to spot.
- Full Moon has no shadows, is dazzlingly bright and rather bland.
- NEVER look at the Sun. You can project the image though.
- Small telescopes: Reflectors give you more light gathering power for your money

What Telescope to Buy

- Decide what you want to observe the most.
- Decide on a budget
- Typical telescope providers: Celestron or Skywatcher series are good for beginners.
- **Smart telescopes** are another option for deep sky photography. More later.
- Reflector or Refractor: The larger the aperture the better: It gathers more light and gives better resolution. A 150mm objective lens/mirror is better than 100mm. Reflectors are much cheaper than refractors for the same aperture.
- Mount: If possible, go for an **equatorial mount**. It makes tracking a lot easier, as once it is properly aligned, you only have to move on one axis.

Telescope Mounts



Equatorial Mount: Easier to track objects and is essential for long exposure astrophotography: Polar alignment needed

Altazimuth Mount: Easy to use for casual observing. No setup needed. Not good for long exposure astrophotography

Magnification

Calculate magnification by using:

Magnification m = Focal length of objective lens / Focal length of Eyepiece

Example: If your main lens/mirror has a focal length of 1000mm and the eyepiece is marked as 25mm, then m = $\frac{1000}{25}$ = 40 times magnification.

Similarly a 10mm eyepiece gives 100 times magnification.

However, magnification isn't everything!!

As you increase magnification you also:

- Decrease the brightness (spreading the light over a bigger area)
- Increase the speed of drift in the eyepiece
- Magnify the effect of turbulence in the air

The Moon: A Good Start

View with a small telescope or good binoculars if steady.

Learn a few crater names:
Plato (60 miles across) – top left with smooth dark floor.

Eratosthenes (40 ml) – at the end of the Lunar Apennine mountain chain.

The Moon: A Good Start 2

Gibbous Moon:
Typical view with good binoculars or small telescope.

Crater: Copernicus (55 miles across) – near terminator

The Moon: More Detail

Copernicus to Tycho

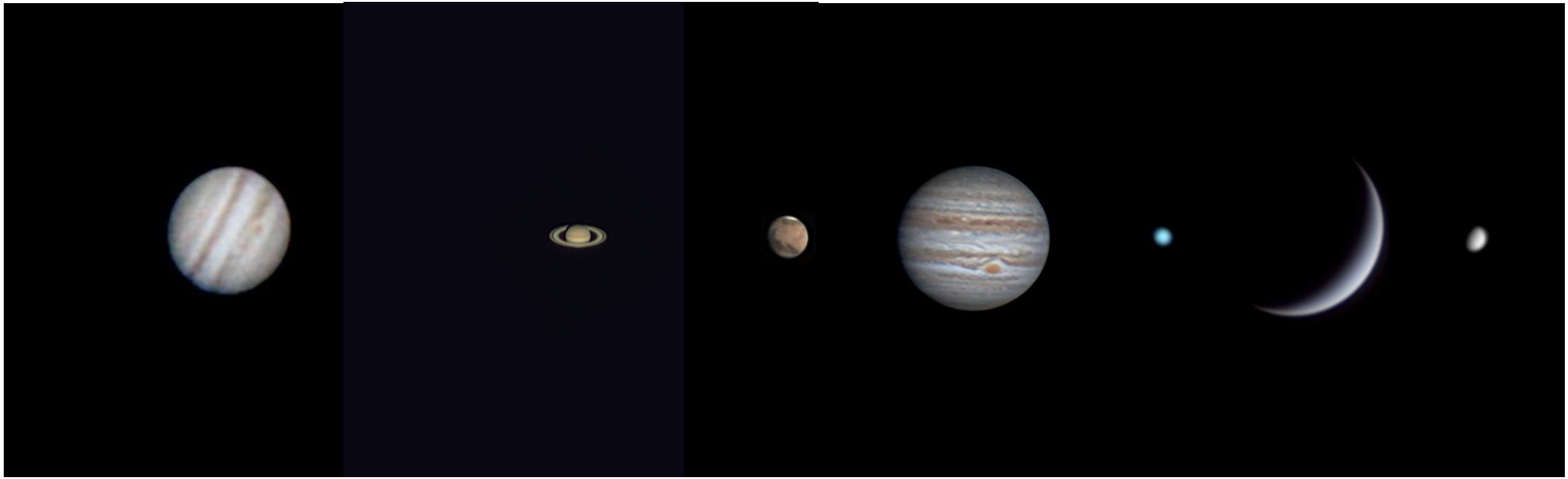
This view can be obtained with a 6” or 8” reflector.

Copernicus – bottom left
Tycho – top right.

This is low magnification. A higher magnification would show more detail

This is an asteroid crater in Arizona. Look how close it came to hitting the visitor center....

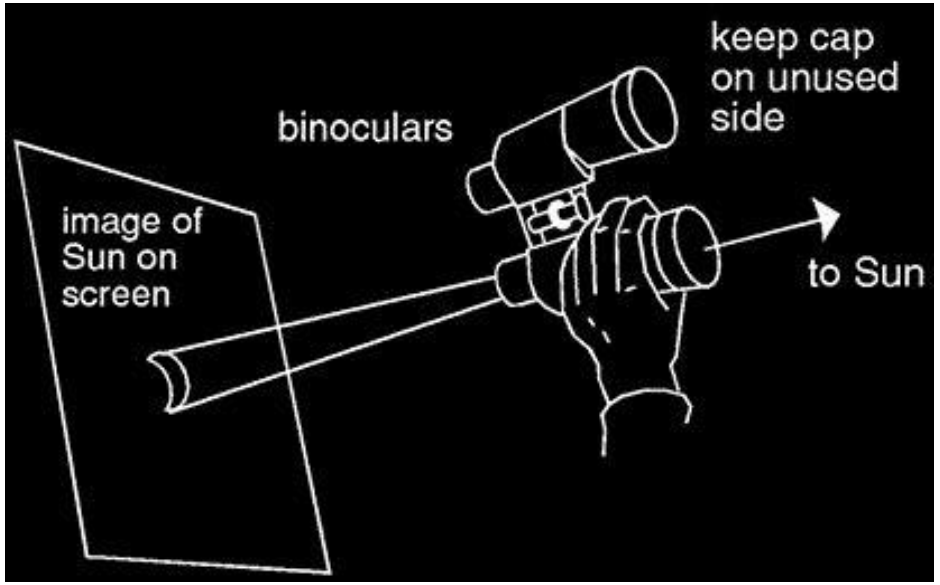
The Planets

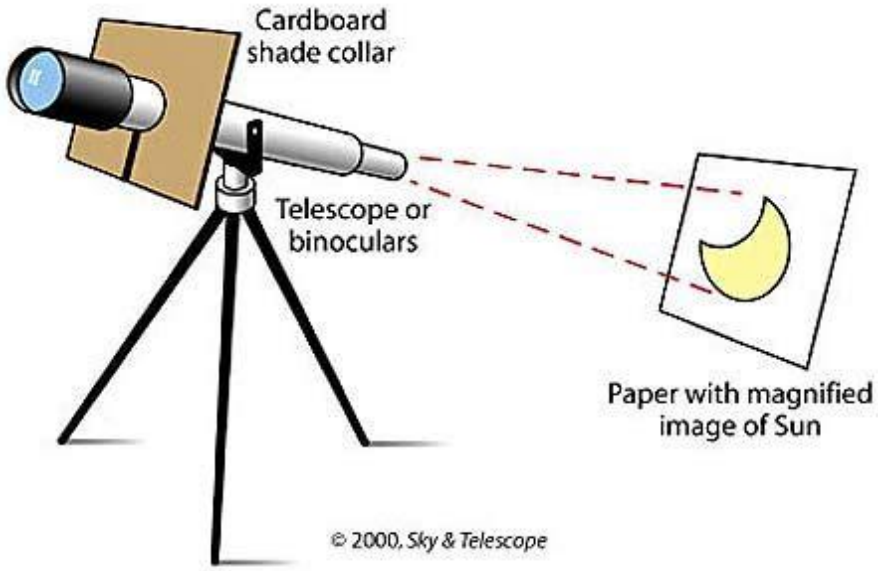


With a small telescope, surface features of some of the planets can be seen. Jupiter is the best – the belts, the Great Red Spot and it's 4 main moons are easy.
Saturn is smaller, but the rings and the main Cassini division can be seen. Also some moons – e.g. Titan
Mars is small and more tricky, but a polar cap may be seen and some dark surface features.
Venus will be featureless in a small telescope as we see only the cloud tops. Mercury will be too small to see features, but the phases of these will be easily seen.
Note: Always use a low magnification to find an object, then centre it, then increase magnification

Observing the Sun

- **NEVER** look at the Sun directly, or through a telescope or binoculars
- It is possible to buy special filters or to make your own using proper Mylar film bought for the purpose.
- Projection is probably the safest way to observe eclipses or see sunspots:





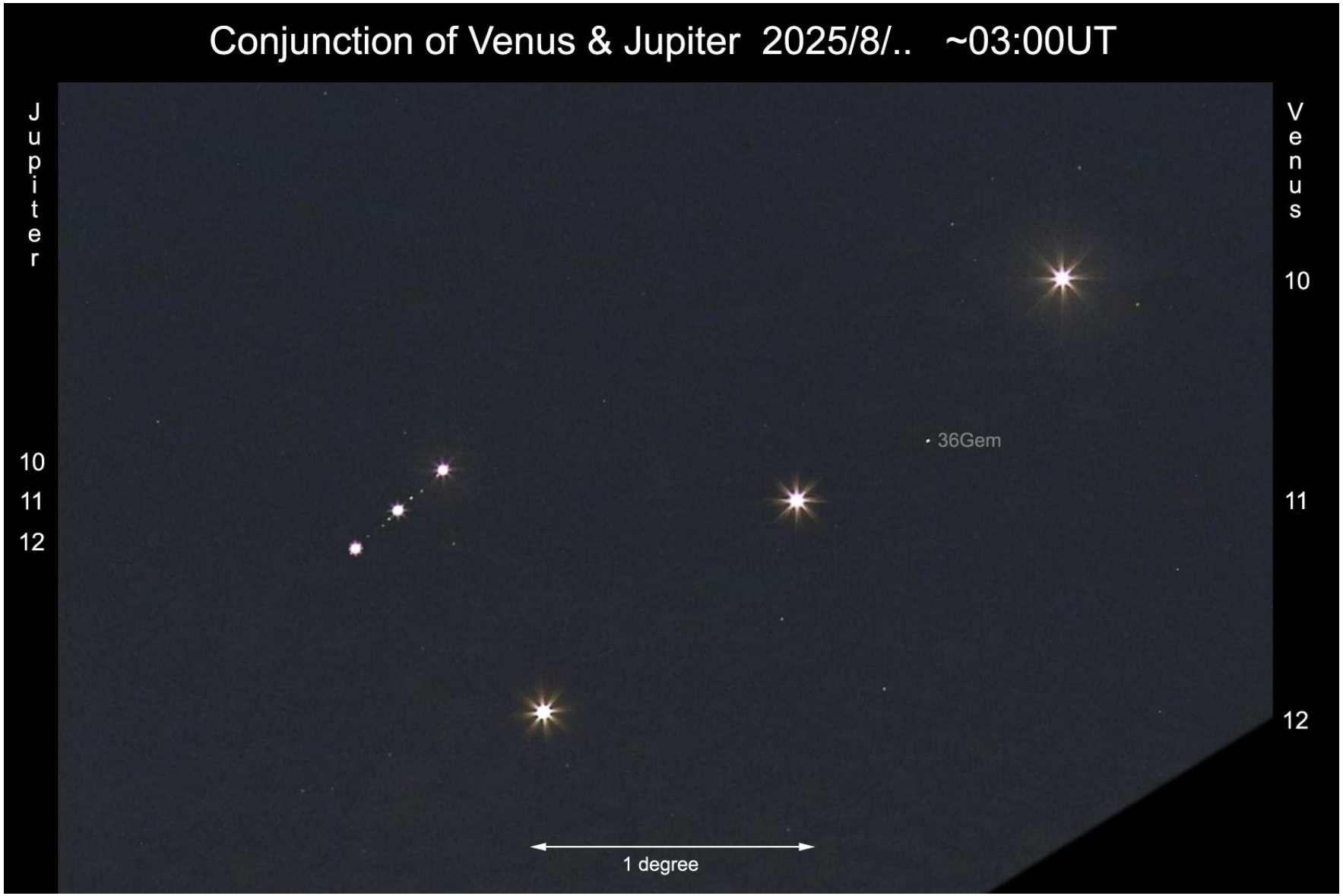
Observing the Sun : Sunspots

Observing the Sun : Partial Eclipses

Galaxies and Nebulae

- Firstly: Don’t expect to see these in colour, like in Hubble images.
- Our eyes do not detect colour in low light levels, so nebulae appear grey and cloud like (where the name ‘nebula’ comes from)
- Bright ones, like M42, the Orion Nebula, can still be impressive
- Make sure your eyes are thoroughly dark adapted.
- Don’t use your phone torch. Any light source should have a red filter and not be bright. **Only use it where absolutely necessary**.
- If your telescope is portable, try to get away from city lights to a dark sky.

Naked Eye: It's Not All About Telescopes!



Simple photos using a camera without a telescope can be achieved.

This is a conjunction (an apparent close approach of two objects) between Venus and Jupiter.

Image: Courtesy of James Weightman

Naked Eye: Auroras

10th May 2024 Aurora
Charlton Kings

Canon 6D with fisheye lens.
8 – 15mm f/4
ISO 800 exposure 10sec.

Photo: Neil Havard

You can get various free Apps to alert you to Aurorae.
e.g: Aurora Pro and Aurorawatch UK

Naked Eye: Auroras

Aurora: 10th October 2024

Charlton Kings

Canon 6D with f/4 fisheye lens.
ISO 1600 Exposure: 5 sec

Photo: Neil Havard

Naked Eye: Meteor Showers

- Telescopes are no use in watching these.
- You only need a deckchair and a dark sky. The first is easier than the second.
- You do need patience.
- You DON'T need a torch!!
- Allow at least 15 minutes for your eyes to become dark accustomed and then face the general area of the 'radiant' (where they appear to radiate out from.
- Best showers can be the Perseids (late July- mid August), Orionids (late October) and Geminids (mid December)

Some Terminology

- Right Ascension and **Declination**: These are the equivalent of longitude and latitude in the sky and give the coordinates to find an object. A beginner won't use them much.
- Celestial Equator: This is the earth's equator projected out on the to 'Celestial Sphere' – i.e the sky.
- Ecliptic: This is the plane of the Earth's orbit. All the planets orbit within a degree or so of this plane. It is at an angle of 23.5 degrees to the celestial equator (due to the Earth's tilt).
- Celestial Poles: The axis of Earth projected on to the celestial sphere. Polaris North Star) is very close to the North Celestial Pole.

Celestial Sphere