# Stargazing

A short introduction to the joys of astronomy

By Furness and South Lakes Astronomy Society

To accompany Louise Beer’s Evening of Stargazing & Storytelling

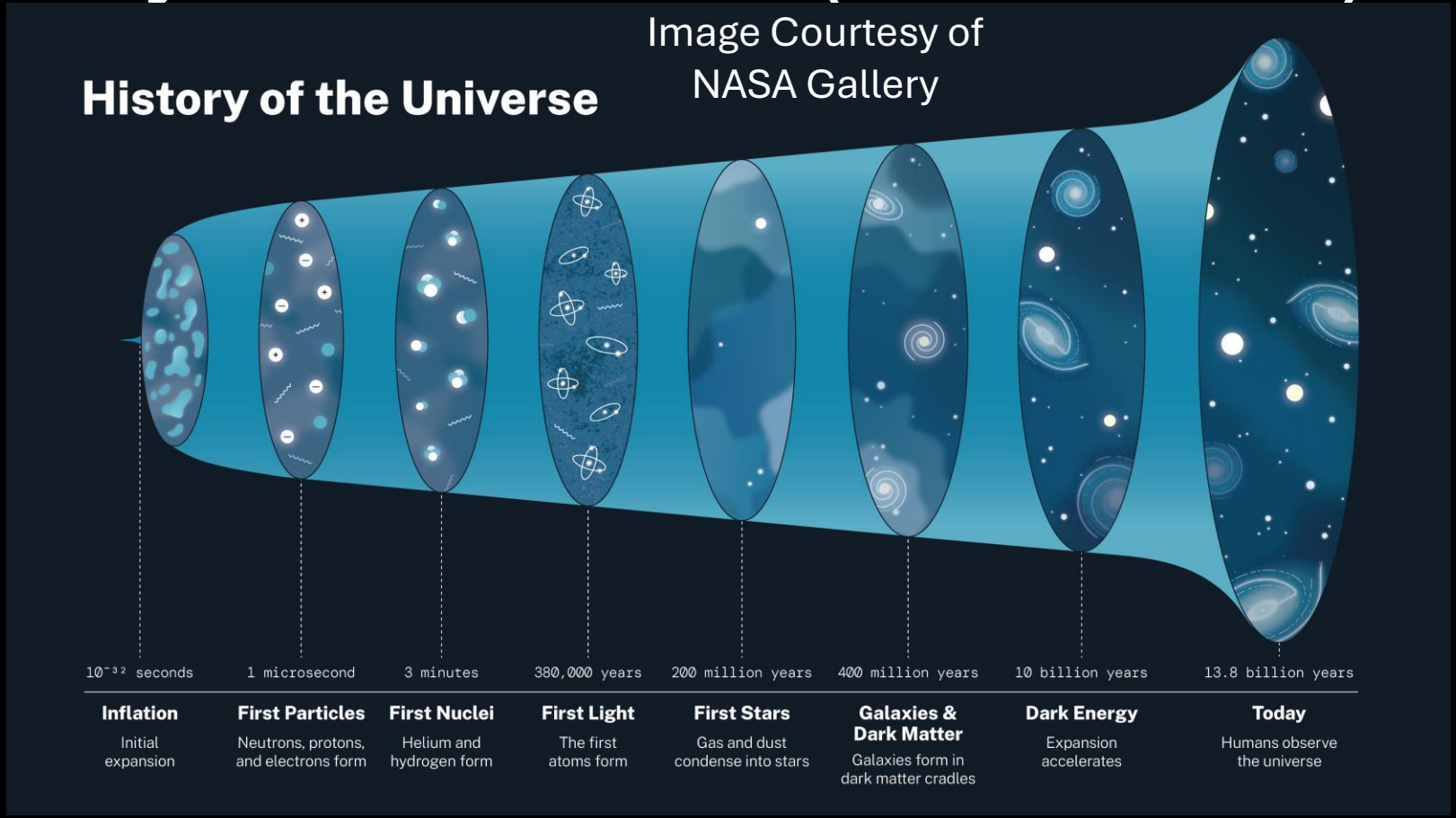
For Art Gene at Allotment Soup

# The Universe

13.8 billion

- Cosmologists believe the Universe is approximately 13.8 billion ($13.8 \times 10^9$) years old.
- The Big Bang

Image Courtesy of NASA Gallery



# The Milky Way (our) Galaxy

Milky Way 13.6 billion

The Universe 13.8 billion

- Cosmologists believe the Milky Way is approximately 13.6 years old.

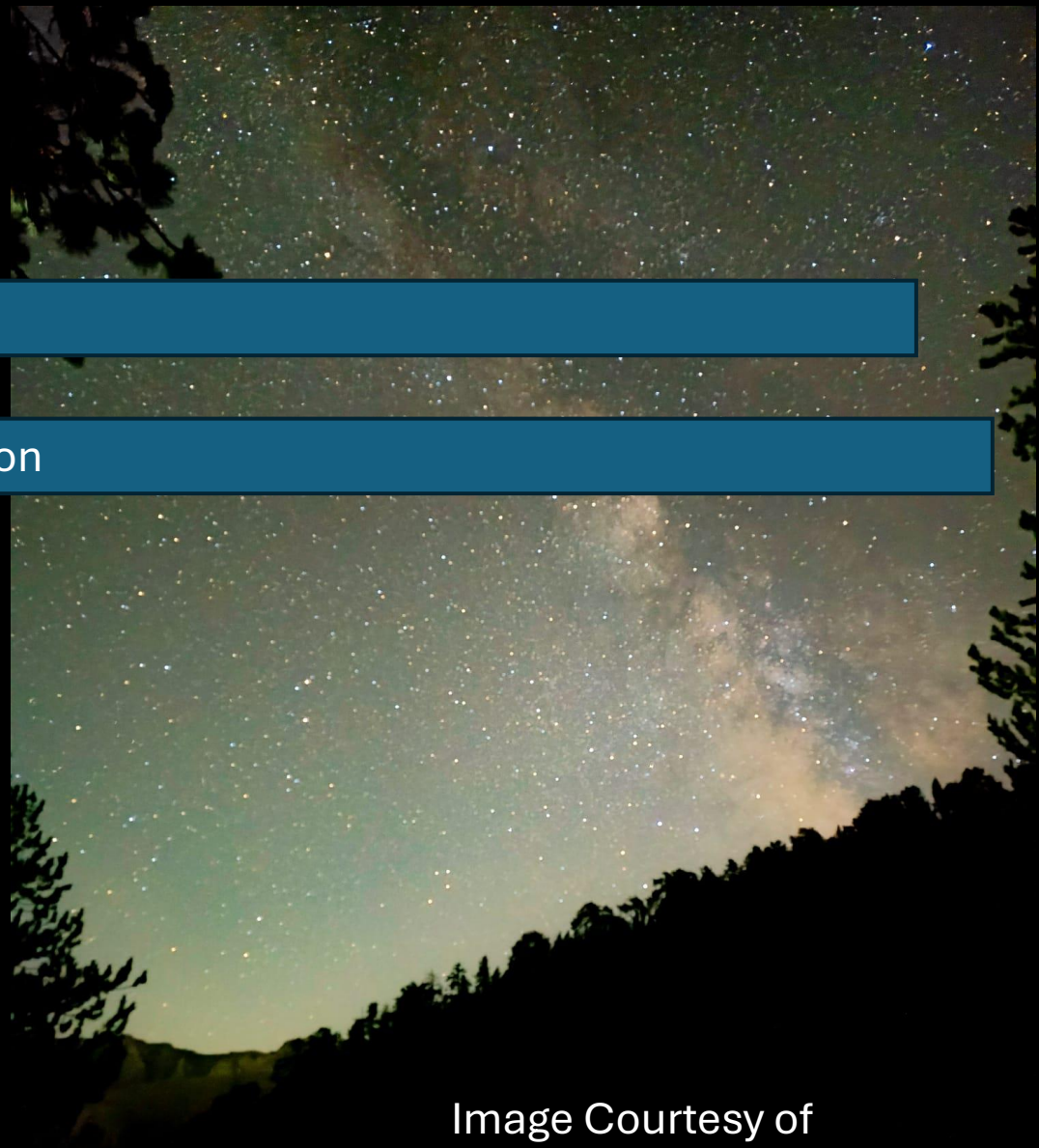


Image Courtesy of Daniel O'Donnel

# The Solar System

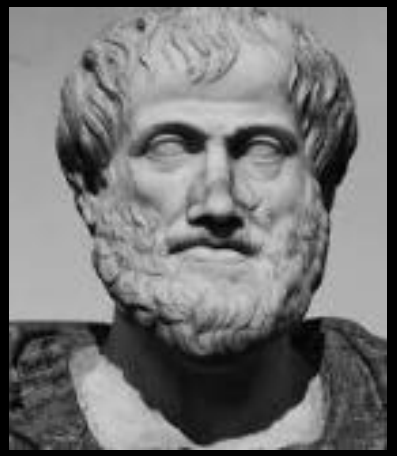
- Cosmologists believe the Solar System is approximately 4.6 billion years old.

Image Courtesy of NASA Gallery

Solar System 4.6 billion

Milky Way 13.6 billion

Universe 13.8 billion



# Astronomy, the oldest science in the world?

- For 300,000 years or so people have looked to the stars.
- Ancient Chinese, Egyptian, Babylonian and Greek societies made accurate observations of the skies.
- Records of astronomical observations date back to the 6$^{th}$ Century BC.
- If Aristotle, Ptolemy, Copernicus, Galileo or Newton could look up at a clear night sky today they would see the same stars and constellations they saw 2500, 2000 and 500 years ago.
- It is only 102 years since Edwin Hubble proved that there was more to the universe than the Milky Way.
- Today the James Web Telescope has detected light from distant galaxies formed 13.4 billion years ago.

What is in the sky tonight?

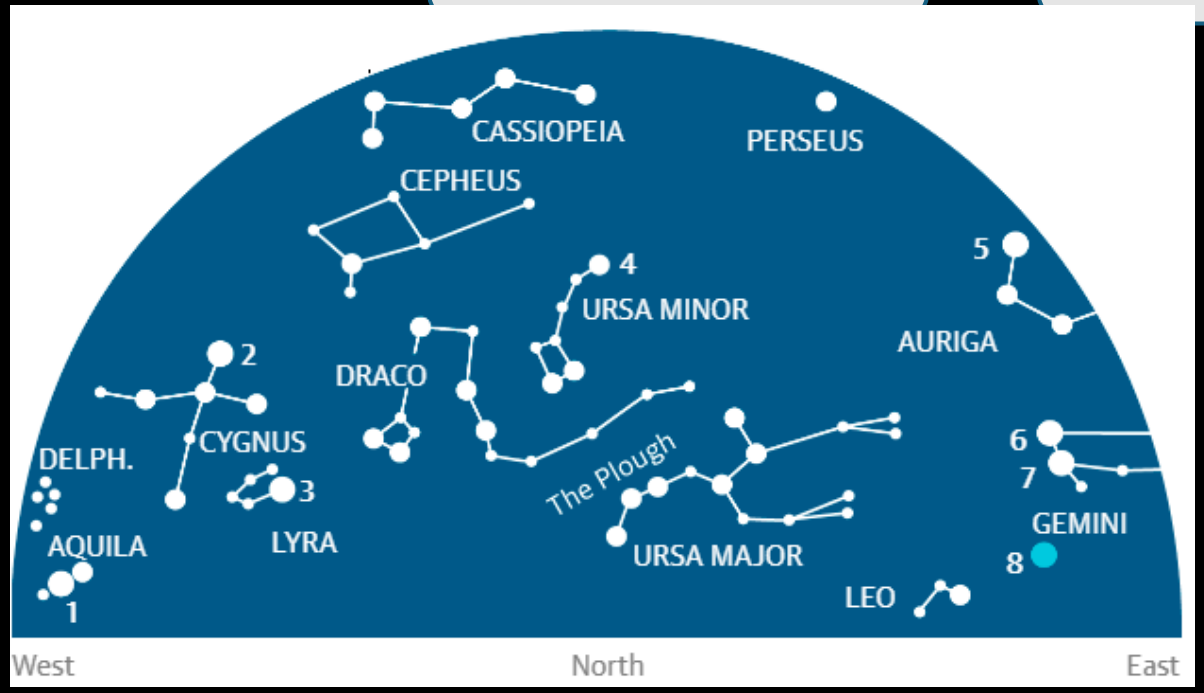
What equipment do we need to see it?

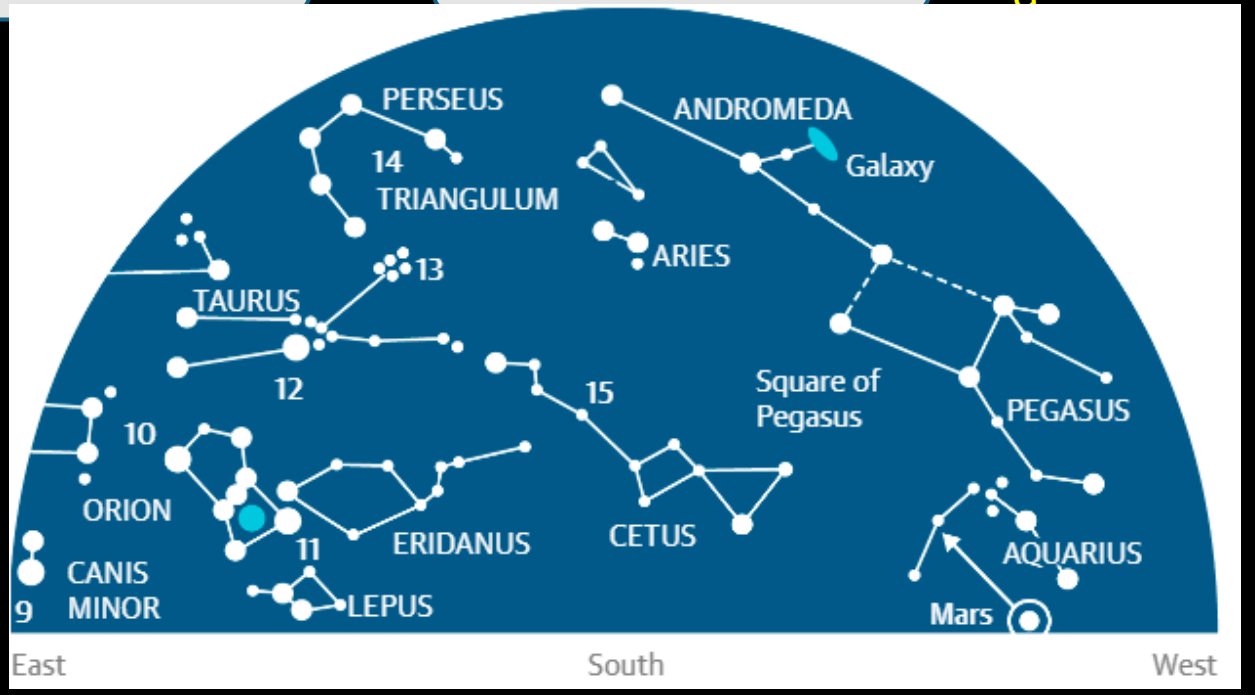
# Constellations

Constellations are patterns of stars in the night sky.

The constellations we see in the sky vary with the seasons.

The winter constellations visible from the UK are:




All we need to observe the constellations is our eyes and a clear sky.

# Stars - Sirius

- Some stars are given individual names.
- All stars within constellations are named after the Latin derivation of their constellation proceeded by a Greek letter assigned in order of the star's brightness in the constellation.
- For example:
  - Sirius is the brightest star in the night sky.
  - Sirius is in the constellation Canis Major.
  - Sirius is also called Alpha Canis Majoris.

We observe stars:

Unaided,
Through Binoculars,
Through Telescopes.

# Stars – Betelgeux and Rigel

- Stars come in different colours and sizes.
- The constellation Orion dominates the winter sky.
- Its alpha star, Betelgeux is a red giant.
- Betelgeux is a variable star that is believed to be entering the end of its life.
- Its beta star Rigel is a blue super giant.
- To the naked eye Rigel appears as a single star but is in fact 4 stars with 3 smaller stars orbiting the main blue giant.
- Betelgeux is not as luminous as Rigel but appears as bright because it is closer.

# Nebula

- Nebula are large clouds of gas, often light years in size.
- The constellation of Orion contains one of the easiest to locate nebula.
- The Orion nebula (M42) is a stella nursery.
- The Orion Nebula is visible to the naked eye.
- Smaller nebular are viewed through telescopes.
- Because many of the gases in nebula emit light outside the visible spectrum astrophotography is often used to show them in their full glory.


# Galaxies

M101 Pinwheel Galaxy

- Galaxies are very large groups of stars and nebula.
- Current thinking is that most galaxies have a black hole at their centre.
- The Milky Way is our solar systems home galaxy.
- The Andromeda galaxy is a similar in size to the Milky Way.
- It is predicted that the two galaxies will collide in 7 to 10 billion years.
- The Milky Way and Andromeda galaxies can be seen with the naked eye. Telescopes with large apertures (usually Newtonian Reflectors) help to provide clear views of galaxies as they gather more light. As well as the visible light emanating from galaxies astrophotography can be used to show emissions outside the visible spectrum.

# Star Clusters

- Star clusters are groups of stars that share an origin, forming at roughly the same time and location.
- Clusters may be open or globular.
- The Pleiades (M45 also called the 7 Sisters) is an open star cluster in the constellation Taurus visible to the naked eye in winter.
- M15 is a globular star cluster in the constellation Pegasus, just visible to the naked eye in dark sky areas.
- A telescope is needed to make out the individual stars in star clusters.
- The Mily Way contains approximately 150 known star clusters that can be observed through armature telescopes.

M45 The Pleiades

M13 Great Globular Cluster in Hercules

# The Moon

- The Moon has  a crust, mantel and a metallic core.
- The Moon is  more massive relative to its primary planet (Earth) than the  moons of the other planets in the Solar System.
- These two facts lead astronomers to believe the Moon was created when another planet, no longer in the Solar System, collided with the Earth.

# Observing The Moon

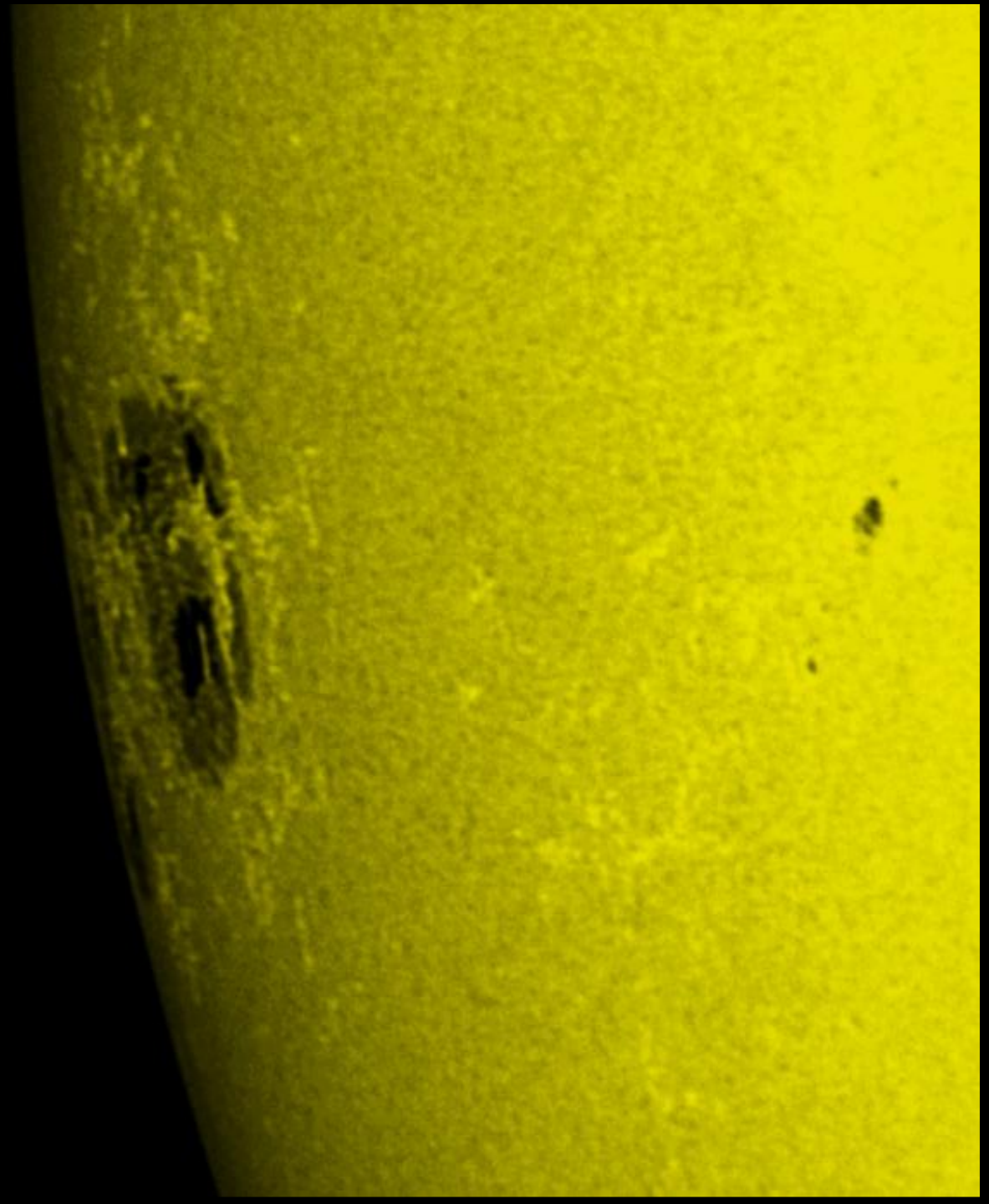
- It’s features:
  - Large planes of lava (Mare / Maria),
  - Impact craters,
  - Mountains (Mons / Montes),
  - Valleys (Vallis / Valles),
  - Cracks in its surface ((Rima/Rimae),
  - Escarpments (Rupis / Rupes),
  - Lakes (Lacus), very small luna mare.
  - Bays (Sinus) where mare meet mons.
  - Marshes (Palus / Paludes) Low lying area similar to of mare that have but with rugged floors.
- Provide endless observation opportunities via small scopes and binoculars.

What is in the sky tomorrow morning?

What equipment do we need to see it?

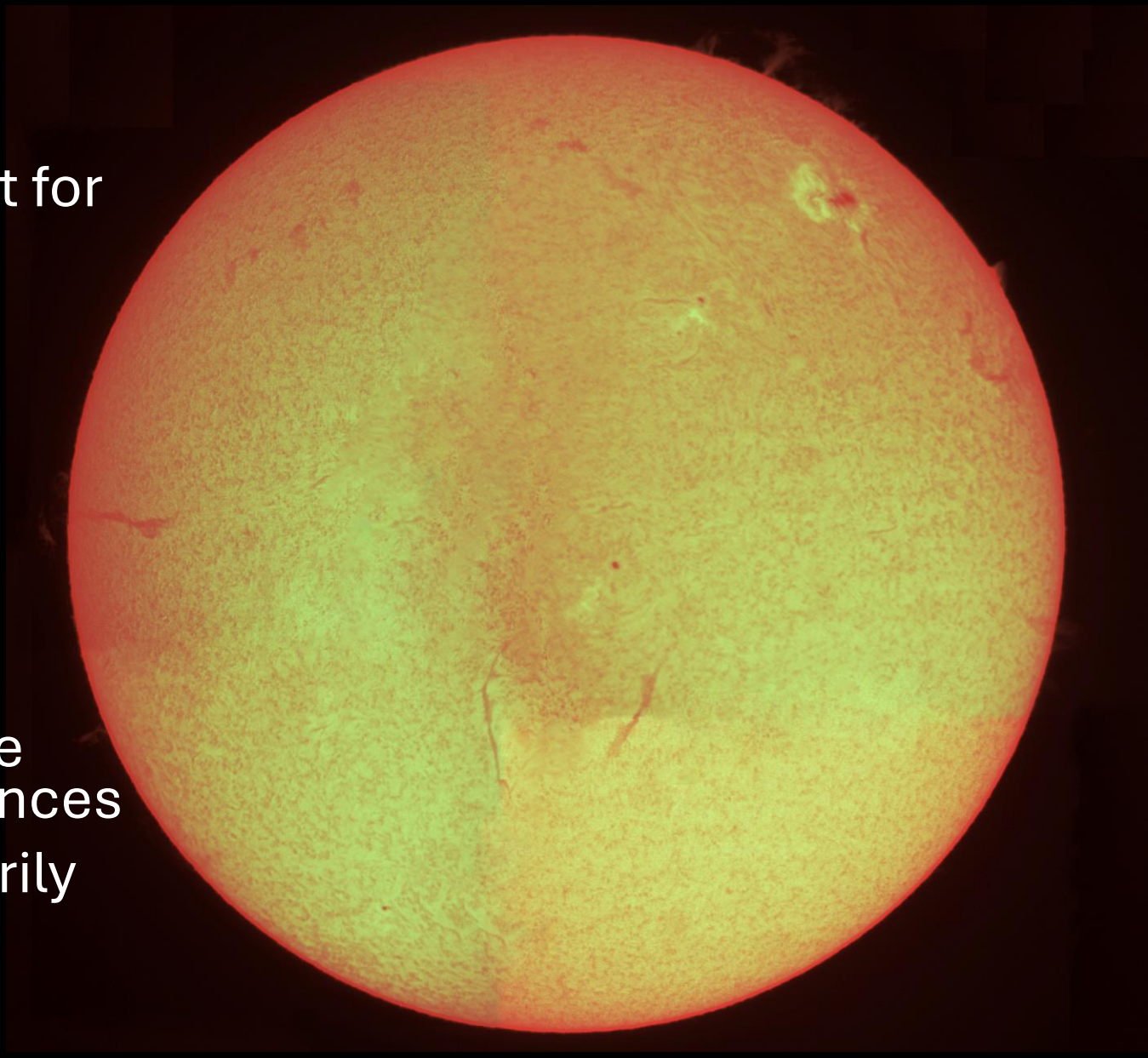
# Observing The Sun

- All the stars we observe appear as points of light, even through a telescope.
- Observing the Sun allows us to examine a star close up.
- DO NOT LOOK DIRECTLY AT THE SUN it can damage your eyes.



# Equipment For Observing The Sun

- The simplest low cost equipment for observing the Sun is solar film, used to create glasses or filters for refracting telescopes.
- A Herschel Wedge can be can also be used with a refracting telescope.
- High cost specialist hydrogen alpha telescopes allow us to observe the Sun’s Chromosphere revealing filaments and prominences
- Calcium-K telescopes are primarily used for high-contrast, detailed imaging of magnetic activity on the sun's surface.

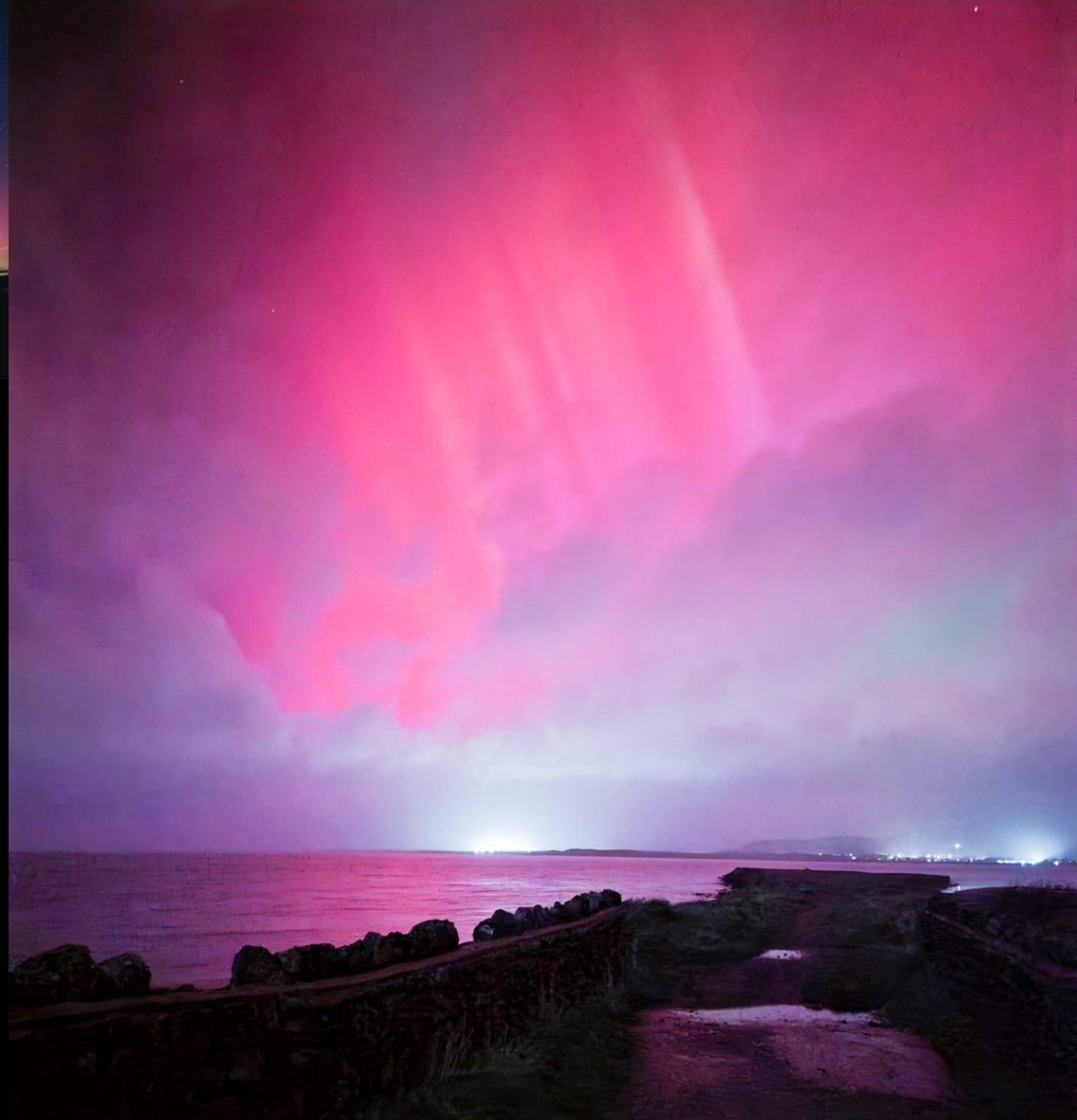


# Aurora Borealis

- Activity on the surface of the Sun has a 7 year cycle.
- We are currently at the peak of a cycle of solar activity.
- This level of activity means that Aurora can be seen at lower altitudes and at times they are visible across the UK.
- Many examples have been captured by mobile phone.
- Websites forecasting Aurora visibility let Aurora hunters know when there a potential opportunity to see an Aurora.

Image Courtesy of Daniel O'Donnel

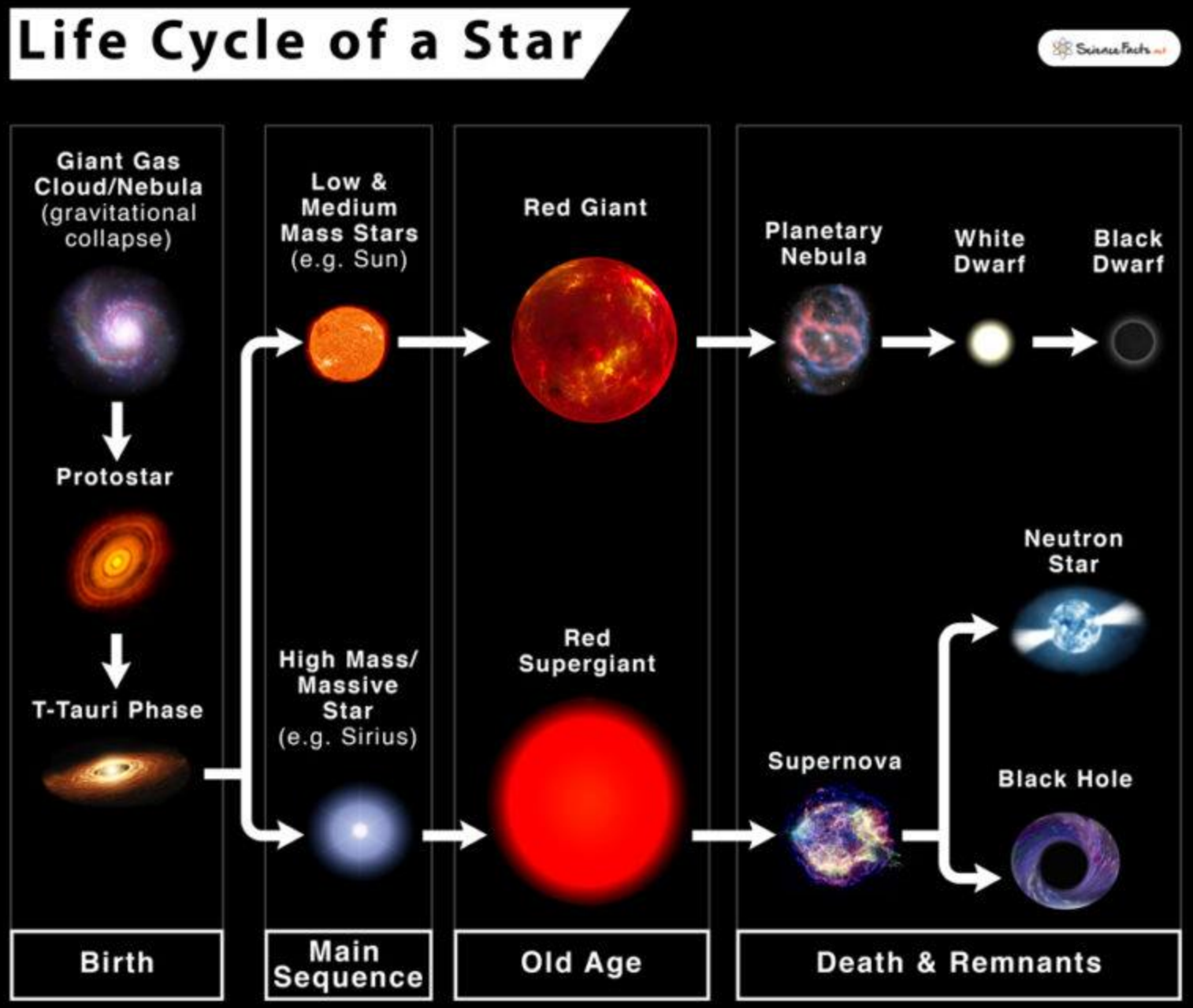
[Lancaster University Aurora Watch UK]



# The life cycle of a star

# We Are Stardust

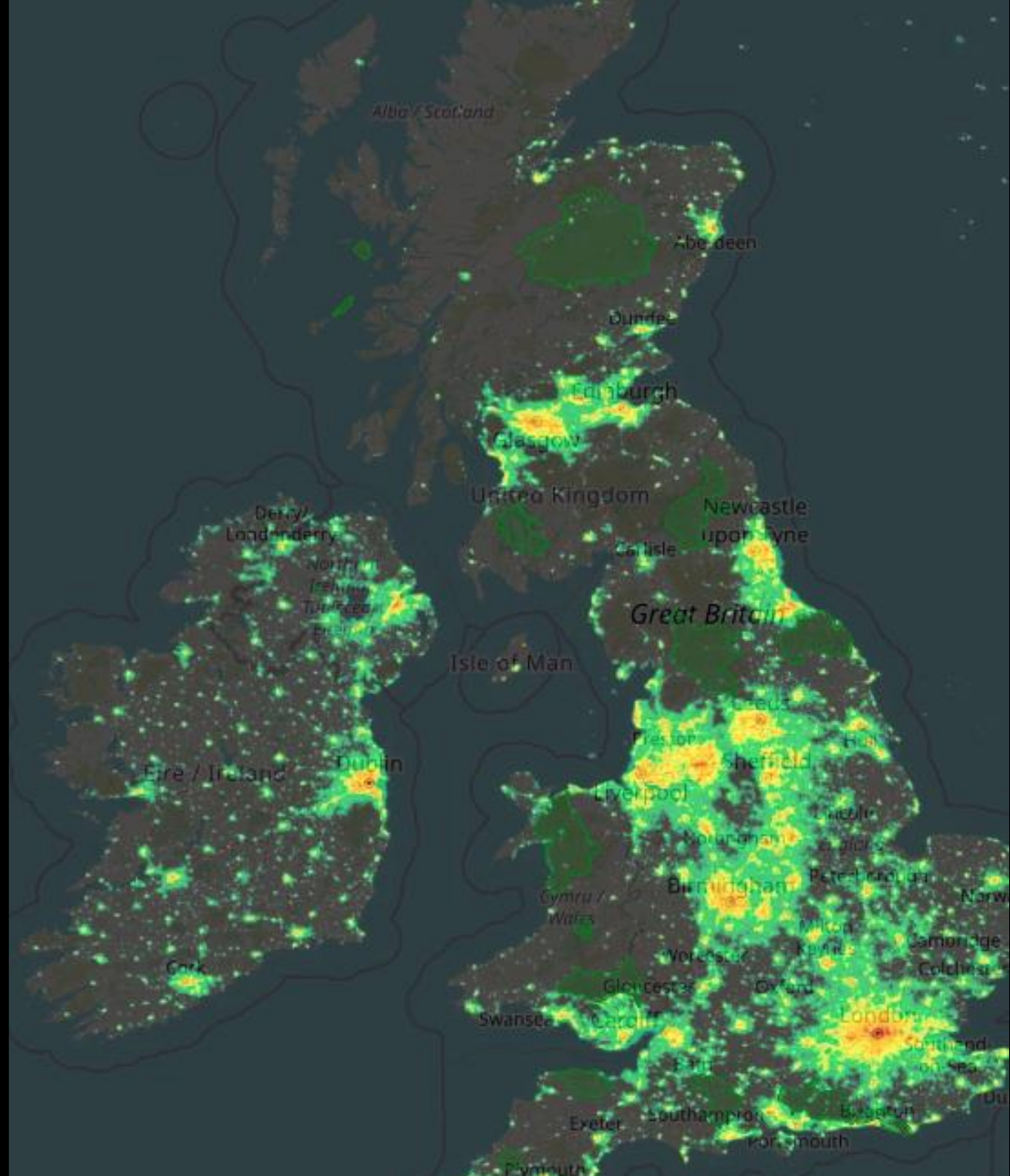
- Stars are formed in nebula when gravity compresses the gas Hydrogen until its temperature reaches approximately 150 million ºC.
- During the millions of years of a star's main sequence nuclear fusion turns Hydrogen into Helium.
- When the star uses up all its Hydrogen Helium undergoes nuclear fusion.
- When Helium is used up fusion progressively creates heavier elements until all that remains is Iron.
- What happens next depends on the size of the star.



# Challenges to Astronomy

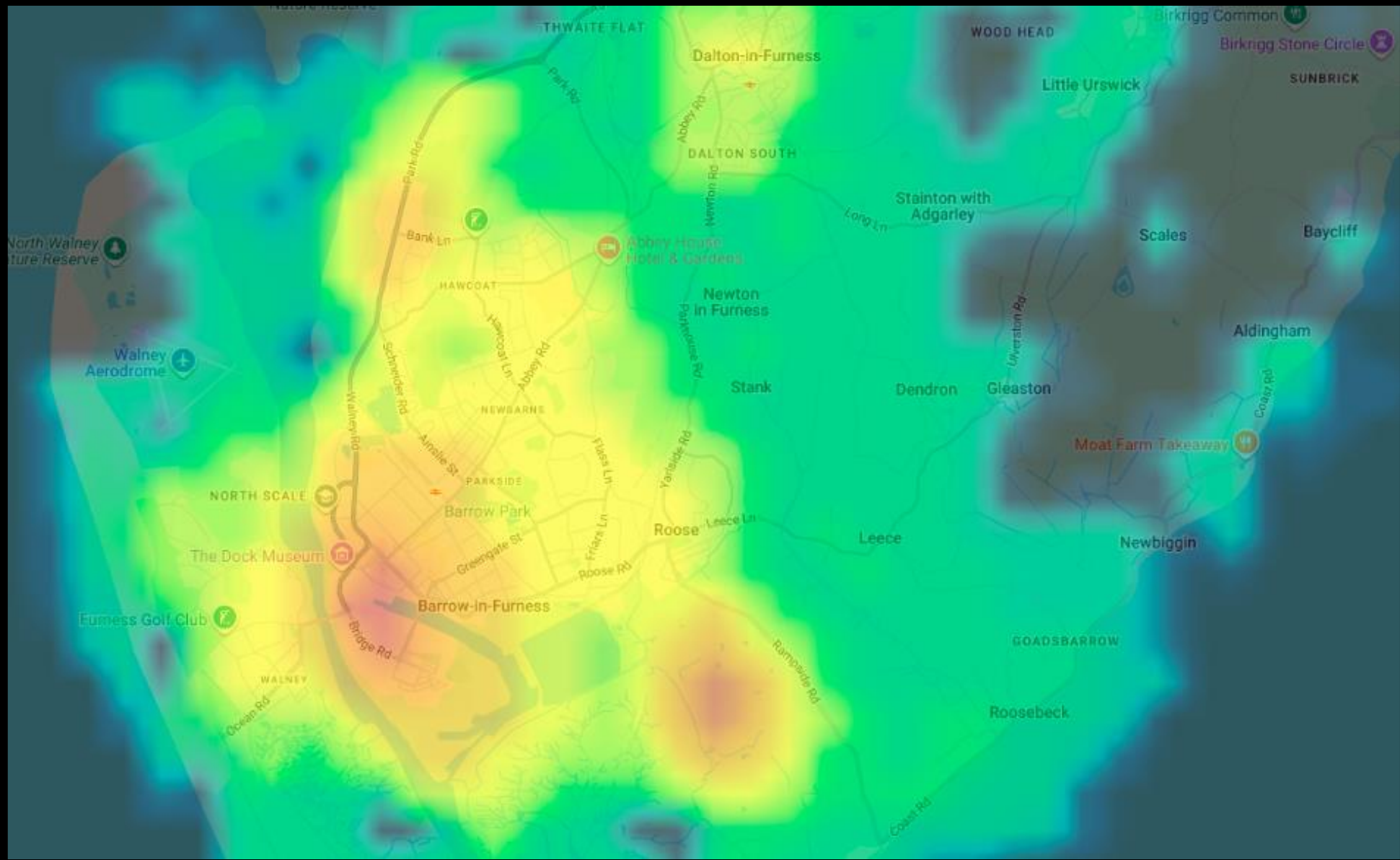
# Light Pollution

- As cities grow larger and street lighting proliferates the glow from villages, towns and cities is drowning out the night sky.



# Light Pollution

- The Barrow peninsula has areas of “Rural” sky and areas of “City” sky.




1
Excellent Dark Sky Site
2
Dark Sky Site
3
Rural Sky
4
Suburban/ Rural Transition
5
Suburban Sky
6
Bright Suburban Sky
7
City/ Suburbia Transition
8/9
City/Inner City Sky

# Satellites

- In 1957 the Soviet Union satellite Sputnik was the only man-made satellite orbiting the earth.
- Today there are an estimated 13,000 man made satellites in low earth orbit.
- Space X alone have applied for licenses for a further 30,000 license
- To armature astronomers these might just cause annoying streaks on their deep space images.
- The increase in low Earth satellites pose a hazard to general space operations, including telescopes like Hubble and James Web.

# Astronomy Equipment

- Scopes, mounts and eyepieces vary in price from less than £100 to over £10,000.
- Starting out it's not easy to know which equipment if right for you.
- Consider joining an astronomy club, members can give you advice and will be happy to let you observe through the equipment they have so you can work out which equipment is suited to your needs before you buy.
- Barrow's local club is:
  Furness and South Lakeland Astronomical Society

# The End

Thanks to the following for contributions:

NASA Gallery Black Hole Image

www.lightpollutionmap.info

# Any Questions?