# WHAT CAN I SEE IN THE NIGHT SKY?

## STARS, PLANETS, GALAXIES, NEBULAE AND SATELLITES

### WHAT IS A STAR?

All of the stars we can see are in our own galaxy, the Milky Way, containing 100 to 400 billion stars.

Stars are suns, just like our own, but much further away appearing as points of light.

They form when gravity pulls massive clouds of gas and dust together until enough temperature and pressure is created to start nuclear fusion in their cores.

For example, the Sun is powered by nuclear fusion in its core, where temperatures reach about 15 million °C.

This process combines hydrogen atoms to form helium, releasing enormous amounts of heat and light.

Stars die when their fuel runs out and have a lifetime of a few million years for the most massive stars to trillions of years for very smallest stars.

The Sun is halfway through its 10-billion-year life.

### TYPES OF STARS

Our Sun is an average-sized yellow dwarf star but there are many other types including red dwarfs, white dwarfs, and red giants depending on their mass and age.

Many stars are in binary pairs rotating about a common centre of gravity. There are also optical doubles that only appear close by chance.

In the Plough, Alcor and Mizar are a binary pair which most people see as a single star but are easily seen as two stars through a pair of binoculars.

Because of their distance from us all the stars appear as points of light with no observable disk except through the very largest telescopes.

### VIEWING CONSTELLATIONS

Patterns of stars, called constellations, were first created by the Ancient Babylonians and Mesopotamians over 4000 years ago to track agricultural seasons and interpret divine messages from their gods.

Successive cultures have selected different patterns and names.

As the Earth orbits the Sun the dark side faces different parts of the sky throughout the year so different constellations are visible.

However, stars and constellations around the pole star can be seen all year, such as the Plough and Cassiopeia, and are called circumpolar.

The pole star, Polaris, is near to the North Celestial Pole, the point in the sky where the Earth's axis is pointing.

A planisphere helps us to visualise this.

## THE CONSTELLATION ORION

A very prominent winter constellation is Orion, the Hunter Despite appearances, none of the stars in Orion have any relationship to each other.

For example, Betelgeuse is about 600 light-years away and Alnilam is twice that distance and only appears related.

The red giant star Betelgeuse is being closely monitored as its brightness is changing erratically and over the course of a few months from late 2019 to early 2020 it faded by 60% in just a few months.

It has been suggested that it is becoming unstable as it nears the end of its life and there is an extremely faint possibility that it could explode as a supernova in our lifetime!

If this happens it will become as bright as a half-moon but will still appear as a point of light.

Orion also has three nebulae in the sword the brightest of which can be seen by the naked eye and is a good binocular object.

## SMUDGES IN THE SKY

Nebulae are interstellar clouds of gas and dust, and Galaxies are collections of billions of stars that both appear as smudges in the night sky.

In the 18th century the French astronomer Charles Messier catalogued 110 faint smudges in the sky, M1 to M110, which would have been a very laborious task with the equipment he had

So, why would he spend years doing this?

These labels are still used today by amateur astronomers and can be seen on the planisphere.

## NEBULAE, GALAXIES AND STAR CLUSTERS

The Orion nebula is the only nebula that can be seen with the naked eye in the northern hemisphere.

The Andromeda galaxy (M31) is the most visible galaxy in the Northern Hemisphere.

From within the Milky Way, we see our galaxy edge-on as a band of light that binoculars resolve into millions of densely packed stars.

The Pleiades (Seven Sisters – M45) are a very bright star cluster where the dust clouds surrounding them can be faintly seen.

## PLANETS

The planets Venus, Mars, Jupiter and Saturn are all very easily spotted, when visible. Binoculars enable the 4 Galilean moons (Callisto, Io, Europa and Ganymede) to be seen as star-like companions.

All the planets, the Sun and Moon lie on the Ecliptic, the plane of the Earth and the Sun.

In the summer the ecliptic is high in the sky in the daytime but low at night. It's the opposite in winter which results in better viewing of the planets.

## THE MOON

Viewing the full Moon when close to the horizon can be very spectacular due to the Moon Illusion.

This makes the Moon appear much larger than it is, but it is just an illusion!

Craters can be seen in much greater detail close to the terminator where the sun's illumination is from the side.

## SATELLITES

Artificial satellites appear like stars that move steadily across the sky and are some of the few things that are better observed on summer nights.

This is because they can only be seen by the reflected sunlight and in winter, when the Sun is far below the horizon, they are often in shadow.

The International Space Station can easily be seen as it's large and reflects a lot of light.

It is worth tracking the ISS with binoculars as it will appear significantly brighter and let you see the background stars it drifts past.

The ISS takes about 90 minutes to complete one orbit of the Earth.

VIEWING NOTES

Many astronomical objects are very dim so it's important to have your eyes fully dark adapted so that they reach the peak of their sensitivity.

This takes about 30 minutes, but a brief exposure to a bright light will lose that sensitivity so the 30 minutes will have to start again!

In dim lighting our colour vision is reduced so everything appears mostly in shades of grey.

That is why space objects do not look as colourful to us as they do in photos taken through telescopes that don't suffer from reduced colour sensitivity.