CHASING THE STARS

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The solar system

About 4.5 billion years ago a star formed that was destined to become home to a system of eight planets. We now know the star as our sun and the planets. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune make up the major planets in something we call the solar system.

There are a host of other smaller objects orbiting around the sun: Pluto (which is now officially classified as a minor planet), a belt containing thousands of asteroids between Mars and Jupiter and way beyond the orbit of Pluto, clouds of comets.

The planets nearest to the sun - Mercury - Venus - Earth - Mars- all have solid surfaces. The outer planets Jupiter, Saturn, Uranus and Neptune are all made of gas and have no solid surface.

The intense energy from the sun pushed most of the lighter elements to the outer reaches of the solar system when it was forming, leaving the heavier elements to form the inner planets and the lighter elements to create the outer gas planets.

Size of the solar system

The sun is the largest of all the objects in the solar system, so large in fact that you could fit one million Earths inside. Jupiter is the next largest object, which is considerably smaller than the sun but you could still fit about 1,300 Earths inside. The solar system itself is so large that light, travelling at a speed of 300,000 km per second, would take 26 hours to journey from one end to the other

Of the inner planets, spacecraft have landed on only Venus and Mars. Mercury has been visited but only by an orbiting spacecraft. These spacecraft so far have been robotic with other robotic spacecraft having visited all of the outer gas planets (or gas giants) - Voyager and Pioneer are the most well known.

Our Moon is the only object in the solar system other than the Earth that mankind has set foot on, although there are now plans for an international mission to Mars which is expected to take place in the next 20 or 30 years.

Most of the planets in the solar system, with the exception of Mercury and Venus, have one moon or more. Our home, planet Earth, actually has three objects orbiting, but the biggest by far is the Moon (differentiated by the word moon by the capital 'M'). Mars has two moons and the gas giants have many but Saturn has the most at about 60.

Astronomers easily see all of the planets without a telescope except Uranus and Neptune. Uranus is just visible with the unaided eye but the skies must be completely dark however Neptune is not visible without optical aid.

Anyone with even a small telescope will be able to see the phases of Venus, the ice caps of Mars, moons of Jupiter and rings of Saturn.

How to be a stargazer

For many people, the night sky is an amazing and inspiring sight. Those interested in taking the next steps to become a stargazer, usually think they must buy a telescope. It may surprise you to know that this is not necessary. There are a number of inexpensive things you can do to start you on the road to understanding more about the night sky.

Buy a red torch

Have you ever been in a bright room, and then gone outside into the dark at night only to find that you can't see a thing?

You may have noticed that given a little time, you can start to see things again without any light. That's because your eyes become dark adapted. It takes about an hour for your eyes to become fully dark adapted and, in astronomy, you need your eyes to be adapted to seeing in the dark so that you can see faint objects.

The use of any torch (to read maps or find your way around) will ruin your dark adaptation fairly instantly so you have to wait an hour again before you can see faint objects. Red light is not as intense as other colours so it doesn't affect dark adaptation as much. Astronomers use red lights so that they can still perform tasks such as reading maps in the dark but maintain adaptation to seeing in the dark.

Buy a planisphere

If you buy a telescope first, you will find it hard to find things in the sky. It's a great idea to learn your way around the sky first and to do that, a planisphere is essential.

They cost only a few pounds to buy and can be purchased from most good book shops. Essentially it's a circular plastic disk that represents a map of the night sky. It has a rotating mask on the front which, when moved around to the right date and time, accurately represents which planets and stars can be seen. Learn your way around the night sky first and when you get a telescope, it will be much easier.

Do make sure you get a planisphere for the Northern Hemisphere.

Start reading magazines and books

There is a huge range of magazines and books out on the market. Books tend to be good for learning about objects and magazines are better at showing what's in the sky throughout the year.

Join your local Astronomical Society

One of the best ways to get started is to join your local astronomical society (see useful contacts at back of book). There are many societies in East Anglia all of which are very happy to take beginners and help them get started with astronomy. You generally also get a chance to look through lots of different telescopes and see which you are suited to before buying one.

After you've done all this, you will have taught yourself your way around the sky, learned how you can use a red torch to find your way around maps and avoid tripping over things(!) and have found friends to help you on your next step.

What to look for in the sky and how to photograph

Star trails courtesy of Chris Cook @ www.abmedia.com/astro

Learning your way around the sky is a key skill for astronomers.

Obtaining a planisphere will help you get started but once you can find your way around, what exactly can you see?

Without a telescope there are a huge amount of things that can be seen. The first thing that is pretty obvious is that you can see countless stars.

Stars are huge balls of gas that give off their own light. They come in different sizes, temperatures and colours.

It's hard to see the colour on fainter stars but a number of the brighter ones show it clearly. Betelgeuse in Orion is red and Capella in Auriga is distinctly yellow in colour.

For those who are particularly astute you may occasionally notice one or two 'stars' which seem to move over a period of nights. If you do notice them then you are actually looking at a planet.

On a really dark, clear night you can often see man-made satellites moving over head, which can be seen as tiny specs of light moving steadily across the sky. Sometimes you can even see them disappear as they pass into the Earth's shadow. The International Space Station can be seen too.

To find out times and dates that you can see the ISS (International Space Station) you can log on to www.heavansabove.com and follow the links.

While you are looking at the night sky you may spot a shooting star.

Shooting stars are actually nothing to do with stars, their correct names are either meteors or meteorites. *(*Meteors burn up in our atmosphere at about a height of 100km. Meteorites are larger while the outer burns up in the atmosphere the core falls to earth. The speed the core could hit the ground can be around 500km/h)

As the earth moves around the sun, it sweeps up bits of dust and rock. The debris falls in through our atmosphere and as it falls, it heats up, getting hotter and hotter until it starts to glow. What we see as a shooting star is actually a piece of glowing rock falling through our atmosphere. Sometimes the earth passes through a cloud of debris from a comet - this is when we get a meteor shower.

It is possible to produce some stunning photographs of the night sky. To get detailed shots of galaxies or planets requires a telescope or other optical equipment but its, possible to get some good shots of the night sky with a basic SLR (Single Lens Reflex) camera on a tripod and a cable release.

Try pointing the camera at the North Pole star, open the aperture as wide as it will go and open the shutter for about 20 or 30 minutes.

When the picture is developed you will have captured a picture showing star trails. As the earth spins, it moves the camera to point at a different part of the sky giving the illusion that the stars are moving. Leave it for longer and the trails of stars get longer. You'll also be able to see the colours in stars much more clearly.

Comets and Asteroids

Over the last few years, we have been fortunate enough to have had a few stunning comets in the skies over Norfolk: Hale-Bopp, Ikeya-Zhang and Hyakutake.

Unfortunately, comets are very unreliable. Even when we can predict their paths, we cannot predict with confidence how bright they will be.

Comets are actually very similar to other minor bodies in the solar system but with the difference that they live out in the depths of the space where energy from the sun is sparse.

Because of the lack of heat from the sun, the comet's nucleus collects ice and, as the comet heads towards the inner solar system the ice gets warmer and warmer.

Eventually, the ice changes straight from ice to a gas which surrounds the comet's nucleus. The nucleus is typically only a few metres in diameter, whilst the coma (the gas surrounding the nucleus) can extend for thousands if not millions of miles.

As it moves nearer to the sun, the solar wind (energy that constantly streams from the sun) pushes against the coma which then extends out from the comet forming its tail.

It's a common misconception that a comet's tail 'flies' behind. In fact, the tail, always points away from the sun, regardless of the direction its travelling.

The beauty of comets is that you don't need a telescope to see the. Binoculars or naked eye observations are by far the best for comets as telescopes magnify them too much for general observing.

Asteroids

Asteroids have a slightly different composition to the cometary nucleus and the vast majority of them are found in a belt that orbits the sun between Mars and Jupiter.

A number of the bigger ones can be seen visually from Earth with amateur telescopes but most of them require photography or much larger instruments to be seen.

There are a number of asteroids too that actually follow their own orbit and even pass the orbit of the Earth.

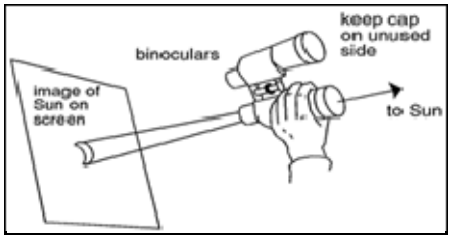
These are known as Near Earth asteroids and there are a surprisingly high number of them although none is known to be on a collision course with Earth for many hundreds of years.

It is thought that an asteroid colliding with the Earth could have led to the demise of the dinosaurs millions of years ago.

How to observe the sun

The sun is our nearest star. There is nothing particularly special about it other than the fact that it is so close to us and gives us the heat and light we need to survive.

The sun, along with the Moon, is one of the most well known astronomical objects although many people probably don't realise it. Although it's very bright, fine detail can be seen on the sun with only a small amount of equipment.



Never look at the sun directly with either telescopes, binoculars or the unaided eye. It can and will lead to permanent damage to your eyes.

Many small telescopes are supplied with solar filters which fit over the eye-piece. They are not safe and should be disposed of immediately.

The only safe solar filters fit over the end of the telescope that is nearest the sun and are known as aperture filters. There are many different sorts but these are best left until you have gained more experience. If you have a telescope or pair of binoculars, then you can safely look at magnified images of it by projecting its light onto a piece of paper.

To start

1. Set your telescope or binoculars onto a tripod. If you are using a telescope, cover over any finder telescope so sunlight can't pass through it and with binoculars cover over one 'half' of the binoculars.

2. Point the telescope at the sun and look back at the ground to see the shadow of the equipment on the ground. As you move the telescope around you will notice that the shadow gets bigger and smaller, so find the point where the shadow is at its smallest and the telescope will be pointing at the sun.
Do not look at the sun at any point during this stage

3. Now take a piece of white card or paper and place it behind the eyepiece of the telescope or binoculars about one foot away.

Don't place too close to the paper or card because excessive heat will burn it.

You will see a bright white disc projected onto the paper.

To make your image nice and sharp you can use the usual focussing adjustments on your telescope or binoculars. You will see some tiny dark spots which are sunspots, which are often larger than the Earth

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Learn about moon rock. Be guided around the night sky in our planetarium.
Take part in a 50 - minute presentation with Starchaser.
(Booking advisable)

Find out more and book your place by calling CSV Norfolk Action Desk.
at BBC Radio Norfolk on 01603 631631

USEFUL CONTACTS

Breckland Astronomical Society
Observatory 07767 834586
www.breckastro.supanet.com

Norwich Astronomical Society
General enquiries 01953 602 624
www.nas.gurney.org.uk

North Norfolk Astronomical Society
John Prockter 01328 830 770
www.nnas.org

Waveney Astronomy Group
Paul Durrant 01502 568 947
durrantpaul@yarhoo.co.uk

Neatherd High School Dereham. Astronomy club
01362 697 981
www.neatherd.org/astronomy

Orwell Astronomical Society (Ipswich)
Ipswich@ast.cam.ac.uk

Institute of Astronomy of the University of Cambridge
01223 337 548
www.ast.cam.ac.uk

Particle Physics and Astronomy Research Council (PPARC)
01793 442 000
www.pparc.ac.uk

European Space Agency
www.esa.int/esaCP/index

NASA
www.nasa.gov

BBC Norfolk website - astronomy for children
www.bbc.co.uk/norfolk/kids/astronomy

BBC Space
www.bbc.co.uk/science/space

The Society for Popular Astronomy (lots of information for beginners)
www.popastro.com

Weasner
Observation guides for the smaller telescope of 6" or less
www.weasner.com

Space weather
Information about the Sun-Earth Environment
www.spaceweather.com

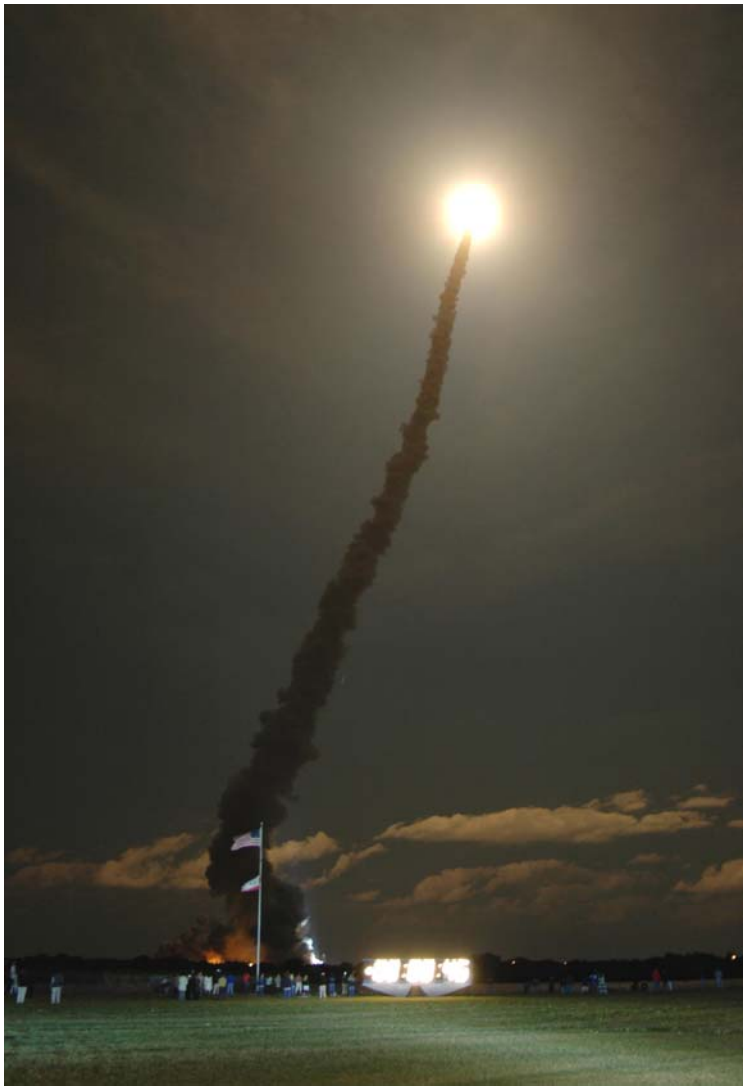
British Astronomical Association
0207 734 4145
www.britastro.org

Earth and Sky
Specialist Astronomy booksellers, mirror re-silverers.
www.earthandsky.co.uk

Ukaranet
Resource centre for armature radio astronomers.
www.ukaranet.org.uk

Royal Observatory Greenwich
0208 312 6565
www.nmm.ac.uk

Inspire Discovery Centre
01603 612 612
www.inspirediscoverycentre.com



Lighting up the night sky as the shuttle Discovery races to orbit. Courtesy www.nasa.gov

Heavens Above
All the information you require for observing the International Space Station, the space shuttle and other satellites. www.heavens-above.com