



stargazing



what is it?

Stargazing, or astronomy, is the study and enjoyment of the stars, plus other objects in the night sky including galaxies (groups of billions of stars); planets (which orbit stars); and other rocky things flying around, like asteroids (chunks of rock in orbit around stars - there's an asteroid belt between Mars and Jupiter); comets (chunks of rock that come from outside our solar system); meteoroids (similar to asteroids, but much smaller); meteors ('shooting stars', when a meteoroid enters the earth's atmosphere and burns up - if it reaches the earth, it's a meteorite).

A star is a ball of gas so massive that its gravity causes unimaginable numbers of nuclear fusion reactions at its core, which give off heat and light. They're like gigantic forges that create all the elements that are eventually scattered across the universe when stars explode as supernovae. We (and everything else on earth, including the earth itself) are all ultimately made of 'stardust'.

We now know that the universe is some 13-14 billion years old and composed of many billions of galaxies. Our own, the Milky Way (we can sometimes see its 'arms' as the 'milky' band stretching across the whole sky on a clear night), is home to our solar system, comprising the Sun, its planets, moons, asteroids, rocks, and dust. Our Sun is a 4.5-billion-year-old, third-generation star - one among the 100-400 billion stars in our galaxy - on course to explode in 5 billion years or so after expanding and swallowing up everything else in the solar system.

Distances to stars and galaxies are so huge that they're measured in light-years, i.e. the number of years it takes for their light to reach us. So if the light from a star (travelling at almost 300,000 km per second) takes 100 years to reach us, it's 100 light-years away. When we look at the stars, we're looking back in time - even the Sun, the light from which takes 8 minutes 20 seconds to reach us.



Galileo's telescope, through which he became the first person to see the rings of Saturn (although he thought they were moons at first).



On a clear night you could see the Milky Way - the 'milky' band across the sky; you're actually looking looking through the densest part of our own galaxy, due to the fact that it's relatively flat.

History: since prehistory, stars have been interwoven with religious and mythological beliefs. Seasons were important to early agrarian communities and the stars served as a calendar; stars were also fundamental to early navigators.

The ancient Greeks calculated how far away the Sun and planets were, and proposed models to explain the movements of the planets. Aristarchus posited that the planets revolved around the Sun.

The Renaissance marked the beginning of true astronomy in Europe. Copernicus, Kepler and Galileo championed the heliocentric model, in opposition to the Church, and eventually prevailed. Planetary orbits were explained by Newtonian mechanics and later refined by Einstein's Theory of Relativity. In the 20th century, Lemaître proposed the Big Bang theory and Hubble discovered that all parts of the universe are indeed moving away from each other. Around the same time, an early astronomical photograph of the Andromeda Galaxy (previously thought to be a solar system) led to a revolution in our understanding of the universe: for the first time people began to realise that the stars and other galaxies were hundreds if not thousands of light years away (we now know that Andromeda is in fact 2.5 million light years away). The discovery in the 1960s of cosmic microwave background (CMB) radiation, or 'echoes' of the Big Bang finally led to it being adopted as the standard explanation for the origin of the universe.

Are we alone? In the 1960s, scientists also began to look for evidence of alien life. Certain sugar molecules have been discovered in distant clouds of gas and dust that have the potential to create the basic building blocks of DNA; and there are potentially hundreds or thousands of planets with the conditions required to support life in our galaxy alone. Maybe we won't be alone forever.



what are the benefits?

The benefits of stargazing can be roughly grouped into navigation, inspiration and contribution. A little knowledge about the positions of the major constellations can help to orientate you and, once mastered, celestial navigation techniques can be used anywhere in the world.

Stargazing is great for getting you out of doors and learning about the night sky. Staring up at a sky full of stars is a beautiful, awe-inspiring experience that really puts things in perspective. It's mind-blowing to think about how small our planet is. Kids in particular tend to love learning about the stars (hunting for aliens seems to be particularly appealing).

Astronomy is one of the few sciences where amateurs and professionals can really engage in a conversation, and amateur astronomers get to participate in huge discoveries and projects. Astronomy has long been the testing ground for physicists like Einstein, and revolutionary discoveries are still being made all the time. Who knows, spend long enough looking up and you might be lucky enough to be the first to spot a comet and have it named after you.

what can I do?

Before you start: astronomy is a huge field, but you can take baby steps by learning the patterns of the planets' orbits, the main groups of stars and constellations, and the lunar monthly and annual cycles. There are lots of websites and books to help you, or you could join an astronomy association and maybe meet like-minded stargazers. Reading about NASA's astronomy picture of the day over the course of a few months can also teach you a lot; plus it might be a really good idea to visit a planetarium - see resources.

Light pollution: it's easier to see stars if it's not a full moon (and the newer the better), and you're away from artificial lights. Don't be put off completely if you live in a city or an area with a lot of light pollution, however. While everyone should experience the breathtaking sight of stars in a really dark sky at least once in their lifetime (the UK has a few 'dark parks' where you can do this - see darkskydiscovery.org.uk), for beginners, a certain amount of light pollution can actually make it easier to pick out the larger, brighter stars and constellations.



Our neighbouring galaxy, Andromeda, is twice the size of the Milky Way, and is expected to collide with our galaxy within 4 billion years, forming a giant elliptical or disc galaxy.

Naked eye, binoculars or telescope? there's a lot you can see just with the naked eye. You'll see more with a good-quality pair of binoculars, which will set you back about £60. Consider buying a camera tripod mount to keep them steady.

If you get sufficiently hooked to want to buy your own telescope, a good entry level one can be had for £120-£150. The bigger it is, the more sensitive it will be. Don't rush into it - it's worth saving up for a good-quality one and finding someone who can teach you to set it up properly.

Safety: stargazing is a safe activity, but if you're spending time outdoors at night, make sure you're well wrapped up, have sufficient food, water and a fully-charged phone. Also, let someone know where you're going and make sure you don't fall into any holes while you're gazing up at the sky.

resources

- see lowimpact.org/stargazing for more info, courses, links & books, including:
- Giles Sparrow, *the Stargazer's Handbook*
- Consolmagno & Davis, *Turn Left at Orion*
- John Gribbin, *Stardust - how elements are formed in nuclear fusion in stars: mind-blowing*
- britastro.org - supporting amateur astronomers
- stargazing.net - naked eye astronomy
- aplf-planetariums.info/en - international planetarium database
- heavens-above.com - what's in the night sky at your location
- popastro.com - Society for Popular Astronomy

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