Caroline's Almanac

A seasonal guide to the night sky

Winter Skies December to February

HERSCHEL MUSEUM OF ASTRONOMY

BATH ASTRONOMERS established 1781

Cold and frosty, winter is the perfect time to view the night sky. The sky is at its darkest in the winter months and this brings out the best deep sky and planetary phenomena. You just need to brave the darkness and stay warm enough to enjoy it all.

The December Solstice

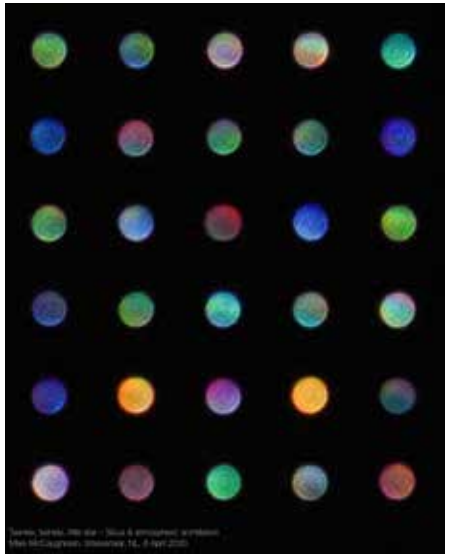
The path of the Sun across our skies reaches its lowest point in our northern hemisphere on either 21 or 22 December each year and we call it the Winter Solstice. The lower Sun means shorter days and longer nights lasting up to 16 hours and 9 minutes; excellent for stargazers. For those in the southern hemisphere, the Sun reaches its highest point and so nights are shorter.

The other benefit of the Sun's path, the ecliptic, being low in the day is that it'll be high during the night and, as this is the path of the planets too, they will be clear and bright showing their best surface detail.

Scintillating Evenings

Twinkle, twinkle little star, how I wonder what you are?

For the light from a star to reach our eyes, it needs to travel tens of thousands of light years before hurtling the last 3 to 10 milliseconds through the Earth's atmosphere. Moving through the atmosphere, the starlight is bent by the air between us and space. If that air is moving a lot due to weather systems, then the amount of bending constantly varies. This creates the effect of stars twinkling. The light from a star above your head travels through less air than one appearing near the horizon and so the stars lower down will twinkle more. Scintillation is the scientific name for twinkling. Red and blue light are bent in the air by slightly different amounts, so if you look at brighter stars, you'll notice them twinkle in randomly changing colours.



Twinkling Sirius © Mark McCaughrean

Some evenings the weather is very still and there is hardly any scintillation. This is perfect for stargazing. Regions of high-pressure weather and a stable jet stream regularly produce these conditions.

My First Telescope

The best telescope for you is one that you will use frequently. As well as budget, you need to consider storage when not in use, weight and transport, type of telescope, ease of putting up and packing away, and simplicity of use.

Try before you buy. Go to a public stargazing event where lots of telescopes are available for you to look through and talk to their owners about the pros and the cons of each model. You could join a local astronomy society, get to know other members, and borrow a telescope to have a go. Perhaps even pick up a second-hand bargain.

You've a choice of refractor (lenses), reflector (mirrors), or catadioptric (both lenses and mirrors) telescopes. Some have long tubes (slow) and others short tubes (fast). There are telescopes on simple up/down, left/right mounts or computerised German equatorial mounts. And every combination in between.

If you've got storage space, don't mind a little lifting, and fancy finding your own way around the sky from your garden, then a Newtonian reflecting telescope of 150 to 200mm aperture on a Dobsonian mount is a good choice.

If you travel to get to darker skies and want to be shown the night sky, then a lightweight fast refracting doublet or apochromatic telescope on an equally light computerised up/down, left/right mount is great. It all fits into a backpack and can be controlled from your phone.

And for a young person's birthday? There is a large range of 'starter' telescopes available but often they have poor optical quality or wobbly mounts making the experience a disappointing one in terms of seeing objects in the sky. Perhaps a mid-range telescope for the family would be a better investment.

Museum Stargazing © Simon Holbeche

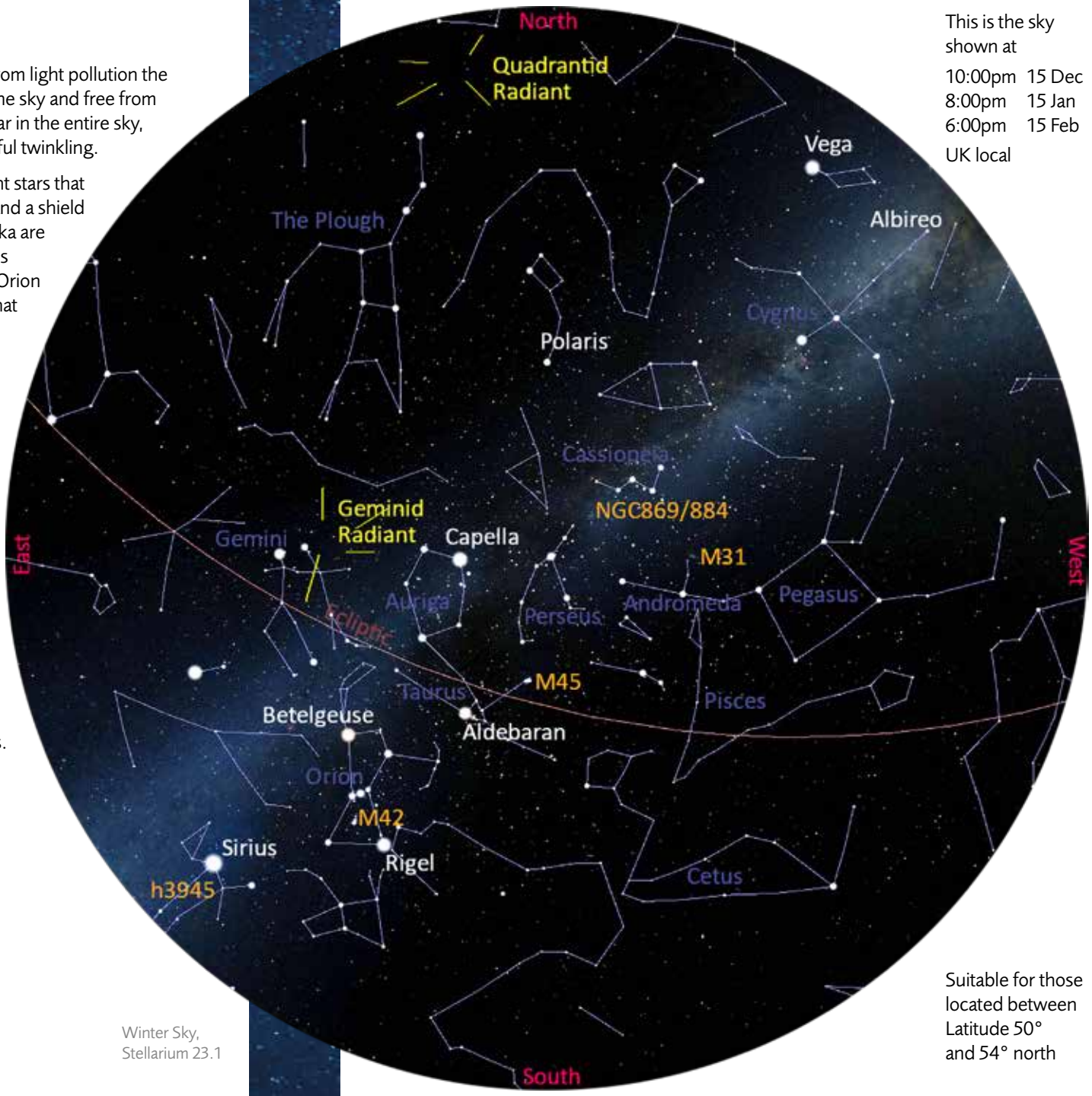
The Winter Sky

This is one of the best times of year to start stargazing. Away from light pollution the skies are inky black and the planets, when visible, are high in the sky and free from atmospheric dispersion or splitting of colours. The brightest star in the entire sky, Sirius, is on show to the southeast; distinctive due to its colourful twinkling.

The constellation Orion, the Hunter, is an arrangement of bright stars that suggests the form of a warrior, with a raised club in one hand and a shield in the other. The three belt stars of Alnitak, Alnilam, and Mintaka are easy to spot. Follow them down to the left to find Sirius in Canis Major and up to the right to find Aldebaran, in Taurus. Above Orion is Capella in Auriga, and if you go the same distance again in that direction, you find Polaris, the North Star.

With a good pair of 10 x 50 binoculars you can enjoy the Great Orion Nebula, Messier 42 (M42) below the belt of Orion before star hopping up to Taurus and the Pleiades open star cluster, M45. Pan up through Perseus to the patch of Milky Way between it and Cassiopeia to see the Double Cluster, a pair of open clusters, NGC 869 and NGC 884, side by side in a sea of other stars. Then pan down and eastward to the constellation of Andromeda and the Andromeda Galaxy, M31.

Now is the time to have a look at h3945, sometimes known as the 'Winter Albireo', in Canis Major. Originally discovered by William Herschel's son, John, it is a double star system with one star a ruddy orange colour and the other greenish blue. You'll need a small telescope to find it, but it is well worth the effort and many regard it as more striking than the colour difference seen with Albireo in Cygnus. With good horizons to the southwest and northeast, you've a chance to catch both in the same evening.



This is the sky shown at

10:00pm 15 Dec
8:00pm 15 Jan
6:00pm 15 Feb

UK local

Suitable for those located between Latitude 50° and 54° north

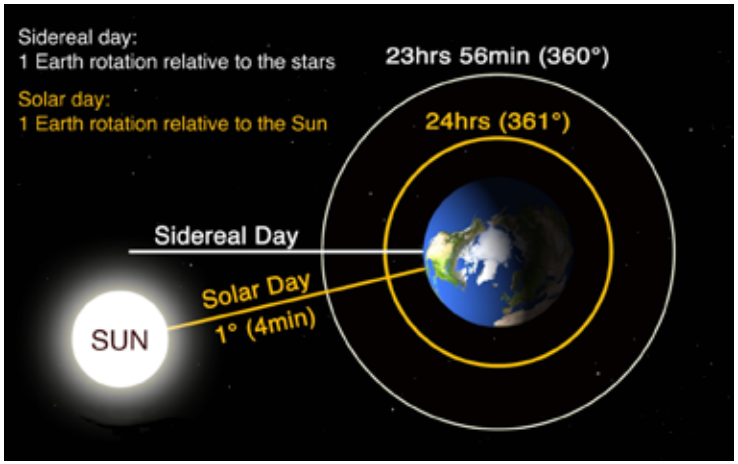
See today's stars online with Stellarium

Winter Sky, Stellarium 23.1

Clockwork Earth

A Solar Day lasts 24 hours: the length of time it takes between the Sun reaching due south in the sky on successive days. In contrast, the Earth actually takes 23 hours, 56 minutes, and 4 seconds to make a full rotation compared to the background stars. This is called a Sidereal Day. But why do they differ? The answer is that Earth is travelling around the Sun as well as rotating on its axis and has to rotate an additional 1 degree for the Sun to appear in the same spot as the day before, taking an extra 3 minutes 56 seconds.

We use Sidereal Time to plot the position of the stars just as we use Longitude on Earth to map geographic positions. The name for this position is Right Ascension. If you know the Solar Time or Local Time a star crosses due south, you can use an equation to convert to Sidereal Time and get the Right Ascension of a star. This is an activity Caroline Herschel would do after a long night's observing to ensure their star charts were accurate the following day.



© James O'Donoghue

Seasonal Meteor Showers

The winter contains the two strongest meteor showers of the year: the Geminids and the Quadrantids.

The Geminids run from 4-17 December peaking on the night of 13-14 December. The debris cloud is associated with 3200 Phaethon, an asteroid of the Pallas family. In ideal conditions you might see up to 120 meteors per hour. The apparent point of origin, or radiant, in the sky is in the constellation of Gemini.

The peak of the Quadrantids is on 3 January. The rate of meteors varies per year but can be over 100 per hour in ideal conditions. The shower runs from 28 December to 12 January each year. The radiant is in the constellation of Boötes, to the left of the handle of the Plough. The meteor dust is believed to come from minor planet 2003EH1.

Decorated by the Late Heavy Bombardment

The Moon looks very different to the Earth although the Apollo missions proved they are made of similar stuff. Without the effect of plate tectonics and erosion, the Earth would also be covered in craters of varying size from a bombardment of asteroids around 4 billion years ago. The Moon's dark seas are solidified magma from a once molten interior and the whiter areas are the original crust from the Moon's creation and cooling.

Of the nearly 83,000 lunar craters larger than 5km in diameter, one is named after William Herschel (41 km diameter, just above the crater Ptolemaeus in the centre of the Moon) and another after Caroline Herschel (13 km diameter, in the northwest of Mare Imbrium on a line between Aristarchus and Plato craters). William's crater has a central uplift or peak which creates strong shadows across its crater floor around First Quarter and Last Quarter, while Caroline's is best seen 3 days after First Quarter and 2 days after Last Quarter.

Shadows cast by the mountains, craters, and ridges are ever changing on the Moon and only repeat after 223 lunar months, the Saros period. So, if you think the Moon looks beautiful one evening, it won't be like that again for another 18 years.

Lunar shadows can trigger pareidolia, the imagination of human faces in random shapes and patterns. One crater famed for this is Clavius, situated at the bottom of the Moon. Best seen around the First and Last Quarters, it is called the Eyes of Clavius. Such interesting light and shadow effects are given the name clair-obscur.

There are many clair-obscur effects visible using binoculars each month, but they are time dependent, lasting just a few hours. The famous Lunar V and Lunar X are letters that appear at First Quarter on the border between sunlight and shadow.

Eyes of Clavius © SVS NASA

Lunar V © SVS NASA

Lunar X © SVS NASA

Keeping Warm

The number one reason why stargazing sessions end is due to the cold. It is not surprising. You spend most of the time standing still looking through a telescope or adjusting it with exposed fingers. So how do some people stay out longer than others? Everybody is different but the key is to minimise heat loss from your feet, hands, and head. For your feet, wear waterproof boots with thick socks. Improve insulation further by standing on a camping or yoga mat. For hands, wear thermal gloves or similar so you can still operate the telescope. For your head, consider a neck warmer as well as a warm hat that goes over your ears.

Wear windproof trousers and coat as well as sufficient layers underneath to achieve the level of comfort required. Ski gear is ideal.

Three final tips.

1. Plan your stargazing beforehand so you have a list of the things you'd like to see to avoid too much waiting around.
2. Move around often to help circulation in your extremities.
3. Bring a hot drink and a snack to help revive your spirits.

About Us

HERSCHEL MUSEUM OF ASTRONOMY

The Herschel Museum of Astronomy is dedicated to the achievements of the Herschels: distinguished astronomers and talented musicians. It was from this house that William discovered Uranus in 1781.

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BATH ASTRONOMERS established 1781

Bath Astronomers are Bath's local community of stargazers dedicated to sharing their fascination with the night sky. They bring telescopes and astrophysics to the public, school classrooms, and community groups.

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Why not join Bath Astronomers?