BLACKROCK CASTLE OBSERVATORY
The Space For Science

# SKYMATTERS

Blackrock Castle Observatory www.bco.ie
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July 2021

## Things to watch out for

### July 4

Mercury will reach its Greatest Western Elongation on this date. As Mercury is extended to the west of the Sun, we will see it rising before the sunrise, in the east. Mercury is west of the Sun, but from our perspective we need to look for it in the east early in the morning.

### July 10

The New Moon falls on this date this month. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This means that there will be no moonlight in the sky to block fainter object, great for observing things like the Milky Way.

### July 24

The Full Moon will fall on this date this month. The Moon will be located on the opposite side of the Earth as the Sun and its face will be will be fully illuminated. This is the best time to observe details on the Moon, such as craters, but the light of the Moon will obscure other objects in the sky.

### July 28/29

The Delta Aquariids Meteor Shower will peak on this date. These are often called to Southern Delta Aquariids, as they radiate from a part of the constellation Aquarius which is above the horizon in the Southern Hemisphere. Unfortunately, this does mean that we in the Northern Hemisphere see fewer of these meteors. The usually rate from this shoer is about 20 meteors passing the zenith every hour, but that will be closer to 10 for us in the north. This shower is often pretty noticeable a few days either side of the peak, but the meteors are usually quite faint and generally don't form trails or fireballs. .

**Directly below this text box, we see a close up of Mercury and the waning Crescent Moon on June 7th at 4:30 am. The Moon here is very close to New.**


**Directly below this text box we see Jupiter and Saturn as they would appear just after sunset, at 11:00pm on June 28th. Both of these planets will rise just after sunset for the this month, but will already be in the sky at sunset later next month. As the planets rise in the southeast, the constellation Sagittarius is just coming towards the south. You may be able to spot it, it is shaped a little bit like a teapot.**

**Bottom of the page we see sunrise on June 7th at 4:30 am. Jupiter and Saturn are visible high towards the south, both will be visible almost all night long for the coming few months. The Moon is a very narrow crescent here, see the close up to the left of this text box.**




**The leftmost image here is a Terrapin sounding rocket, capable of depositing sensors to the same height as many weather balloons. As you can see, it is much smaller than a rocket designed to reach Earths orbit.**
**Top right is an image of the Virgin Galactic Space Plane system, showing both the launching plane (White Knight Two) and the returning space plane (SpaceShipTwo) slung underneath**
**Bottom right is the remains of the massive cannon used in the HARP project to launch sub-orbital sensors á la Jules Verne.**

## Suborbital Space Flight

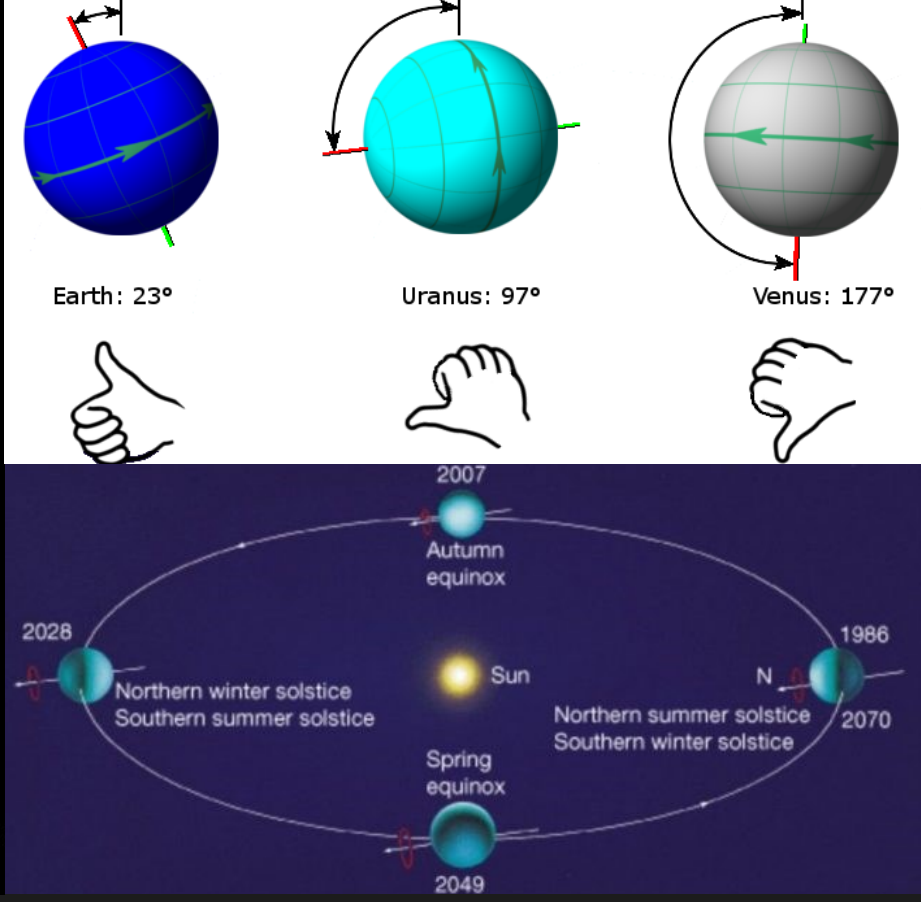
Flying on a plane and flying on a rocket ship are of course quite different. One of the big differences is of course, destination, very few planes will bring you to another planet. This is mainly because of how planes generate lift. Not only do their engines usually rely oxygen from the air to generate thrust, their wings are totally dependant on an atmosphere to generate lift. Hence, no atmosphere, no lift, no flying, at least not in the conventional sense. One way to help separate the two is to call the traditional way atmospheric flight, and call the other space flight. However, just to make things a touch more complicated, you can have flight, through the atmosphere, without wings or oxygen reliant engines. Rocket planes have used rocket fuel to fly, fuel which generates its own oxygen as it burns, but they weren't all designed to get high enough to breach the Earths atmosphere, let alone enter orbit.

This leads to another subdivision. It is possible to leave the Earths atmosphere without entering into orbit. Once you leave the atmosphere, you can't be flying the conventional way, but you also haven't entered orbit. This means that you aren't truly free in space, the Earths gravity will inevitably pull you back down. This is the domain of suborbital space flight. It's definitely space flight, without any atmosphere left to burn or generate lift, but it is certainly different from the path of a satellite or space probe. Space planes in particular are useful here, many of them have the right wings to fly, or at least glide, once they re-enter the atmosphere along with the protection needed to keep passengers safe in a vacuum. This is the style being pursued by Virgin Galactic, one of their space planes Is set to carry the owner of the company, Richard Branson, to the edge of space later this year. The Virgin Galactic space plane, VSS Unity, has already successfully carried a pair of astronauts to space from Spaceport America, the first purpose built commercial spaceport.

Short-hop rockets are also perfect for suborbital flights, and have long been proposed as an alternative to long-haul flights. Although they do use a lot of fuel, a 14 hour flight from Europe to Australia could be completed in just an hour or so, and this could become profitable once there is room for enough passengers. This is the style being pursued by Blue Origins, and its owner Jeff Bezos, along with his brother Mark, plan on making a test journey later this month aboard the New Shepard rocket. Both New Shepard and VSS Unity are currently planned to facilitate space tourism, allowing for short trips into space, usually returning to the same location, or at least nearby, when landing. Further developments will be needed to apply these technologies to transport.

Besides the tourism and transport, suborbital flight has long been used in research. It's the perfect place to study the Earths atmosphere and a great place to release sensors designed to study every part of the Earths atmosphere as they descend through it. Weather balloons are good, but they can only get so high before bursting, where as suborbital flights can make it all the way outside the atmosphere. They are particularly useful for studying remote areas precisely, suborbital rockets are quite small and can be launched from temporary sites such as ships, and they aren't at the mercy of wind direction and speed as most weather balloons are.

Edging slightly closer to science fiction, small objects have been launched to suborbital heights using a space gun, also known as a Verne gun, essentially a gigantic cannon. Only useful so far for smaller payloads, but it could be one more futuristic way to get to space.


**The leftmost image shows a comparison between all planets in the solar system, plus our Moon, inn terms of axial tilt and rotational period.**
**Top right we have the "Right Hand Rule", if your right hands curled fingers follow the rotation of the planet, your thumb points to that planets "north" pole.**
**This is why some people say that Venus spins backwards where as other people say Venus is upside down.**
**Bottom left we have a diagram of Uranus' recent and upcoming seasons, courtesy of Nanjing University, China.**

## Seasons on other Planets

Here on Earth, different places get different seasons. In most of the world, we break the year into four, though some places near the equator simply have 2, wet and dry, while others have six, further subdividing the year. It should come as no surprise that other planets have seasons as well. In past issues we discussed how the Earths tilt is the main driving force behind our seasons. We may have an elliptical orbit, but it isn't quite eccentric enough to have a major effect on our temperature. It does effect the length of the seasons, slightly. Our summer here in the norther hemisphere is really about four days longer than our winter, as we are further from the Sun and travelling more slowly in our orbit. This is of course reversed for the other hemispheres seasons.

Mars is a great example. Its days are just a touch longer than ours and its axial tilt is very similar as well. The big differences are its eccentricity and greater distance. Being further from the Sun gives mars a longer year, just about twice as long, which doubles the length of the seasons as well. The increased eccentricity means that Mars really slows down when it is at its furthest from the Sun, increasing the differences between the seasons length. This leads to a 194 day spring and a 142 day autumn, the difference compounded by the effect of eccentricity and distance. Again, this is for the northern hemisphere, with the south showing the same reversal of seasons as we do on Earth.

Of course, things can get even stranger. Mercury's orbit is highly eccentric, and its axial tilt is even greater than the Earths, which should lead to some wacky seasons. Unfortunately, Mercury's year day cycle complicate matters. Mercury is in a resonant orbit with the Sun, for every two years on Mercury, it returns to face the Sun once. This gives it one "day" every two years, or one year of day followed by a year of night, This means that its seasons are somewhat over shadowed by the huge variation between night-time and daytime temperatures, from –173 up to 427 degrees Celsius. It can be hard to tell if it's meant to be summer or winter if the Sun hasn't risen all year. Luckily for Mercury, this year is a nice short 88 Earth days, making every Mercurian "day" 176 Earth days long, even though its rotational period is technically just 58 of our days.

Possibly most extreme is Uranus, given its extreme axial tilt. The pole's of Uranus experience a similar "Midnight Sun" phenomena as our Earth, the axial tilt keeps the Sun above the horizon for the whole summer. We don't usually consider this one day, but several days between a sunset and sunrise. The days, or rotations, on Uranus are quite short, just about 17 hours. However, the Sun can be risen at the north pole for 42 Earth years. This is just about half of the 84 Earth day year, which works out to be just over 21,500 of Uranus's short days. This is then of course followed by a similarly long "night". At the equator of Uranus, the Sun rises and sets roughly every 17 hours, but will vary between passing over the Zenith at the equinoxes, to barely rising in the south or north during the solstices. Speaking of solstices, the Uranian northern summer solstice is coming up in 2030, the firs since 1944, giving us a chance to see Uranus's north pole head on. This means that the Sun has been up for the north pole since about 2009, it should set sometime around 2051, with a nice few Earth years of sunset glow afterward as well, before returning to 42 more years of darkness.

Our summer solstice may be past, but at least we have a reasonably short enough year to complete before our next one.

## Tips for Bearing the Heat

Although Midsummers Day was last month, for many of us July feels more like the middle of the season, this is usually when the weather is hottest. We've discussed why in previous issues when we explained the lag of seasons. Regardless of the why, we seem to be in for a scorcher, here are some tips on handling it while observing.

Firstly, mornings are often a little cooler than the evenings, especially if the proceeding night was clear. It may be harder to wake up early, but it may be a more comfortable temperature. We are still close to midsummer, so expect a prominent sunrise glow in the east as early as 3 or 4 o'clock.

Secondly, bring appropriate clothing that can be layered. Night time may not be too chilly at the moment, but it is still a good few degrees cooler than midday, so if you are setting up to observe early, you may need another layer or two to stay comfortable once the Sun sets. Also, remember that cool and cooling clothes can protect you from the Sun as well as easing the heat, loose fitting pale clothes are usually a good option.

Thirdly, sunset and sunrise are still sunlight, with all the UV rays that that entails. UV protective lotion is a good idea, even if the Sun is technically below the horizon. Also, it's easy enough to get engrossed in observations and subsequent discussions, which may leave you standing under the morning Sun with no protection!

Lastly, hydration! Your bodies best way to cool you is through sweat, and that water needs to come from somewhere. Drink regularly, even if you aren't particularly thirsty. If you are planning an all-night observing session, it may also be worth packing some electrolytes, so you can replace the salt lost in sweat as well.

## Website of the month

www.bco.ie/events/notes_to_a_star/

Here at BCO, we host many and varied events, from space and astronomy to music, literature and cultural performances.

This month we'll be hosting the eclectic "Notes from a Star" performance, described below.

## Quote of the month

**"When [a] body is hot enough, its radiations become visible, and the body is said to be red hot. When it is still hotter it sends forth... rays of every colour, and it is... white hot. When a body is too cold to shine visibly, it still shines with invisible heating rays... it does not appear that any body can be so cold as not to send forth radiations."**

**"Theory of Heat" by James Clerk Maxwell, 1871**

## Some Upcoming Events at MTU Blackrock Castle Observatory

**Join us on the Low Roof of the castle for a night of classical music and theatre in the one-of-a-kind blended experience that is "Notes to a Star". Combining Shakespeare's best quotations with Beethoven's most evocative movements to produce an incomparable fusion of Bard and Composer.**

**Both artfully illuminating and astronomically high class, this performance fits in perfectly in a dual Castle Observatory. See the link in our "Website of the month" section for details and tickets.**

**Public Opening Hours are subject to change due to COVID-19 mitigation measures.**

**Phone: +353-21-4326120 / Email: info@bco.ie**

**Blackrock Castle Observatory is operated by Munster Technological University and is a partnership with Cork City Council.**

All Screenshots courtesy of Stellarium
Collated by Caoimhín de Bhailís and the Blackrock Castle Observatory team