SKYMATTERS

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February 2020

Things to watch out for

February 9

The Full Moon falls on this date in February. 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 also a Supermoon, the first of four for 2020. The Moon will be at its closest approach to the Earth and may look slightly larger and brighter than usual. The Moon will still be roughly 350,000 km away, and so this will be a very slight difference and is difficult to notice outside of photographs. You can learn more about Supermoons in the March 2019 issue of Skymatters.

February 10

The planet Mercury reaches its Greatest Eastern Elongation of 18.2 degrees from the Sun on this date. This is the best time to view Mercury since it will be at its highest point above the horizon in the evening sky. Look for the planet low in the western sky just after sunset. It will also be visible for some days before and after this date.

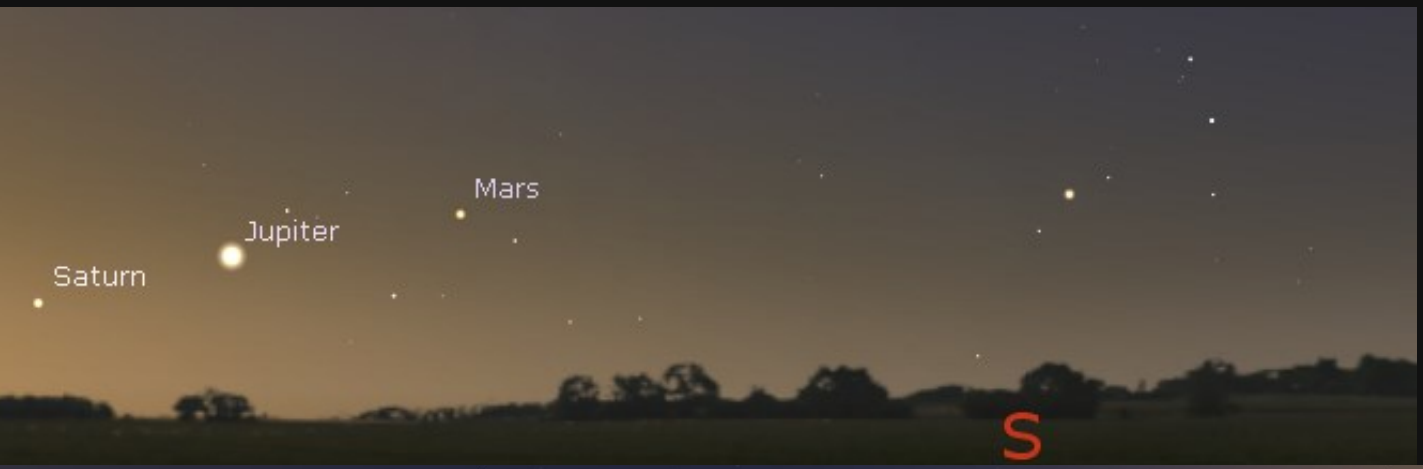
February 23

The New Moon falls on this date in February. The Moon will located on the same side of the Earth as the Sun and will not be visible in the night sky. This is the best time of the month to observe faint objects such as galaxies and star clusters because there is no moonlight to interfere.

All month

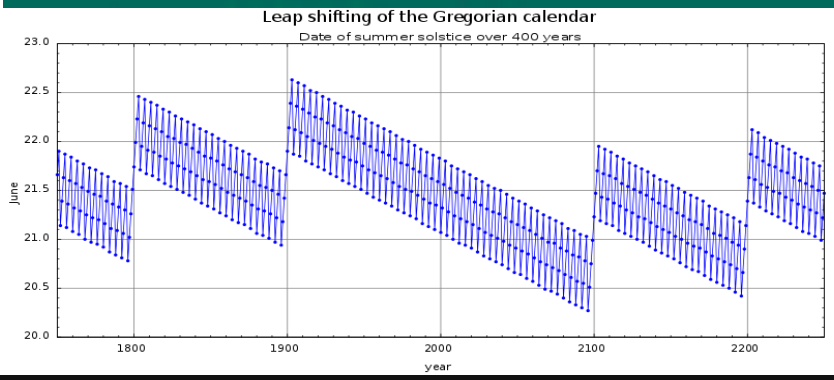
Venus is in the evening sky. Look south-west half an hour after sunset to see this planet blazing brightly. A crescent Moon will be very near Venus on 26 February.

In the below image, we see sunrise on the 29th of this month at 6.40am. We can see the planet Saturn low to the west with Jupiter slightly higher and more to the south, Mars is higher again and slightly further south than Jupiter. All three planets will be visible in a row all month. Due south is the constellation Scorpius, with its brightest star, the red giant Antares at its center. The Greek name Antares is a reference to the god of war Ares, which was the Greek name for Mars. Antares comes from anti-Ares, the only thing in the sky red enough to challenge the redness of the Red planet. They will be close enough in the sky to make a visual comparison of their redness in the morning for the rest of the month.



In the bottom image we see sunset on the 9th of this month at 6.20pm. The planet Mercury is visible just above sunset to the west, with Venus also visible, higher and further to the south. Mercury reaches its greatest elongation on the 10th but is still reasonably visible a few days before and after this date.

JULIAN 1582		October			Gregorian 1582	
Sun	Mon	Tues	Wed	Thurs	Fri	Sat
	1	2	3	4	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						



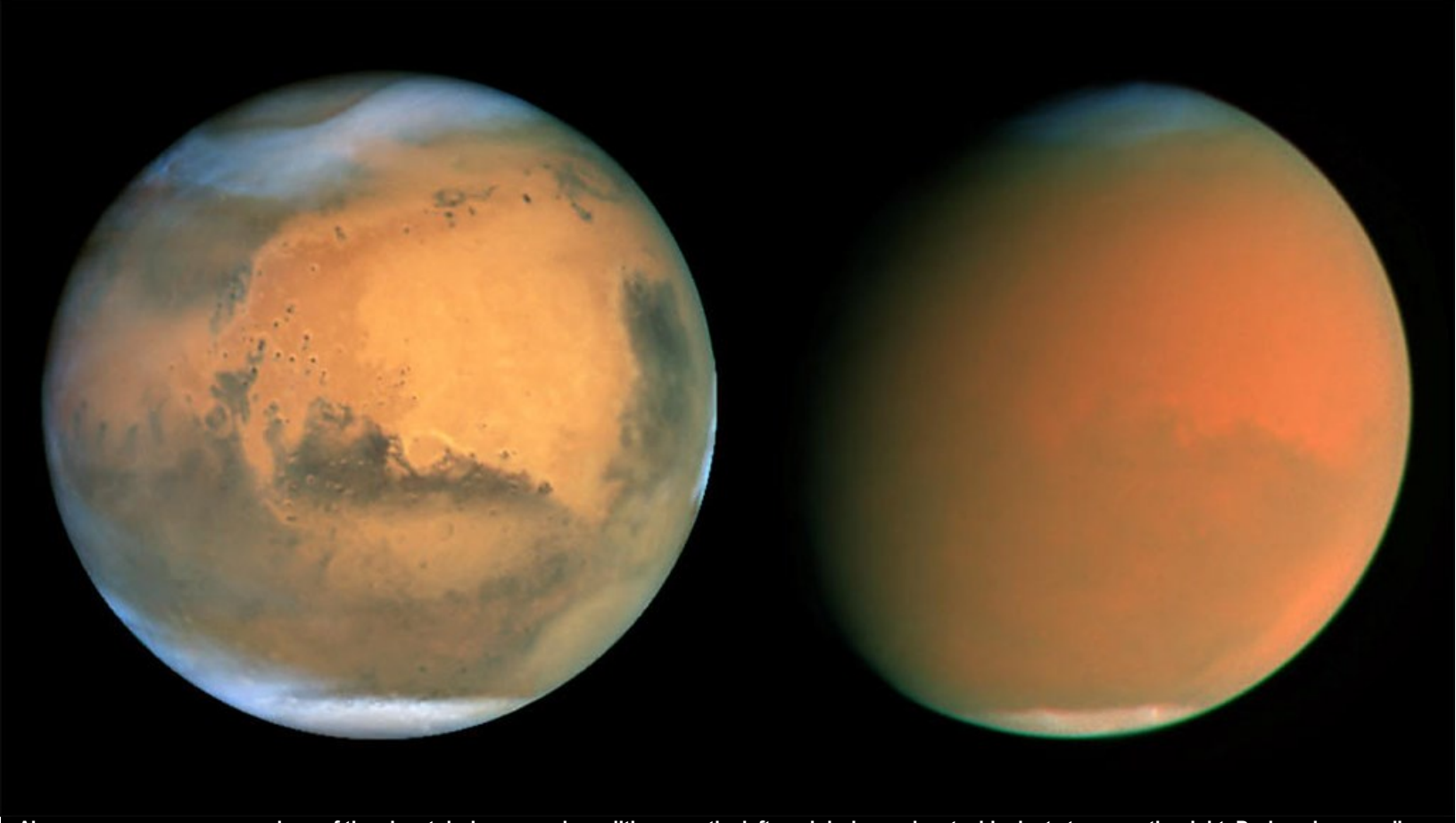
At the top of this page, you can see the time displayed during the addition of a leap second, to keep atomic time in pace with the Earth's rotation. In the bottom left image, the days lost while moving from the Julian calendar to the Gregorian calendar can be seen. This was done partially for the same reason as leap years, to keep the date of the solstices the same from year to year. On the bottom right is a graph showing how the June solstice gradually shifts date and then is shifted back by leap years.

Leap Years, Months, Days, Seconds.

30 days hath September, April, June and November; all the rest have 31 except for February alone . . . And then the poem kind of breaks down. February is our leap month, the month which gains an extra day (the leap day) meaning most years it has 28 days, but on certain years it has 29. These years are leap years. Why we have them is easy enough to grasp, but which years are leap years isn't quite as simple as every 4th year.

The Earth orbits the Sun once every 365.2422 days, not exactly 365 and a quarter as is often believed. For this reason, if the calendar year was always 365 days, it would slowly drift out of agreement with our orbit. It would only take 100 orbits for our longest day and shortest day to change by almost a month, the shortest day would be the 26th/27th of November, and this would continue to fall further out of sync over longer time periods. Although simply adding one extra day every four years improves matters, it still isn't truly accurate. One extra day every four years gives us a year of 365.25, so we're off by around 0.01 of a day. This means the calendar would drift by a whole three days every four centuries! Although this would take a long time to truly become an issue, our current application of leap years is slightly more precise. As well as being a year divisible by 4, the year must also not be divisible by 100, unless it is also divisible by 400. This means that each millennium, we skip some years that would otherwise be leap years, preventing that three day drift from occurring. In our current millennium, 2000 was a leap year and 2400 will also be, but 2100, 2200 and 2300 will not be. This means the length of our calendar year is 365 days, plus a quarter of a day, minus one hundredth of a day, plus one four hundredth of a day. This gives us a year length of 365.2425, much closer to the true value. This prevents any appreciable drift even over quite long spans of time. Of course, this is only our Gregorian Calendar. In other calendars, such as the Julian, leap years are just every four, whereas in the Hebrew calendar, a leap month is added at regular intervals instead. But there is another, more subtle drift at play.

The rotation of the Earth is not truly constant. As well as fluctuations caused by earthquakes and melting ice sheets, our overall rotation is slowing by 1.4 -1.7 milliseconds per century. This means that the number of seconds in a day will increase as time moves on, based on one standard of a second at least. In the past, a second was one eighty-six thousand and four hundredths of a day (1/86 400), so if the day got longer, seconds would get longer. Atomic clocks, on the other hand, have a fixed second equal to 9,192,631,770 periods of the radiation emitted by a caesium-133 atom in the transition between the two hyperfine levels of its ground state. For this reason, the time on an atomic clock and the time as calculated based on the position of the Sun and other stars in our sky slowly drift apart. The current solution is the addition of leap seconds, 37 of which have been added since 1972, as of 2019. This leap seconds are added whenever the difference between atomic time and solar time is around 0.6 milliseconds, the difference is never allowed to go beyond 0.9 milliseconds. Although these extra seconds are announced 6 months before they are added, they are still added in an unpredictable fashion due to the number of factors that influence our rotation. Most of us don't notice if the clock reads 23:59:60, but high-speed internet, timestamp protocols and other areas that require precise timing do see some effects. Many believe that there is a better adjustment than leap seconds, though none of them have been accepted yet.



Above, we can see a comparison of the planet during normal conditions, on the left, and during a planet-wide dust storm, on the right. During clear conditions, which are the most common on Mars, many surface features are visible. There is ice, both water ice and dry ice (frozen carbon dioxide) visible at the north and south pole. During the massive dust storms that cover Mars, most sunlight is blocked from the surface, which can be detrimental to solar powered rovers and other craft on the surface.

Mars

The Red Planet is in a great position each morning this month, above the rising Sun in the south-east. The red colour of Mars in the sky has had a big influence on its name and perception in different cultures. To the Ancient Greeks and Romans, the planet was associated with the deity of war, Ares and Mars respectively, thanks to its red colouration. This assisted its association with conflict and masculinity. In many Asian mythologies, it was known as the fire star, and associated with luck and passion. The Ancient Greeks named another red celestial object, a star in the constellation Scorpius, as Antares, meaning the rival of Ares as it is one of the few stars with a similar red colour. It can also appear quite close to Mars at certain times of the year, including this month, making it possible to see them near each other and compare their colour.

It was not until the invention of the telescope that humans were afforded the opportunity to see Mars up close, and this led to decades of speculation. Galileo was the first astronomer to view Mars through a telescope in 1610, but it wasn't until 1659 that features on its surface were first recognized, when Christiaan Huygens observed Mars's dark Syrtis Major region and included it in a drawn map of the planet. It wasn't until the 1870s that telescopes could give a clear view of smaller features on the planet, although telescopes at this time still suffered from many aberrations, which distort images and create illusions. This caused Schiaparelli, another Italian astronomer, to perceive grooves, or channels on Mars that he called canali. This was mistranslated as canals in some texts, which led to long running speculation about intelligent life on Mars. The French astronomer, mystic and sci-fi author Flammarion wrote many speculative books regarding extra-terrestrial life. These writings are believed to have influenced American business man Percival Lowell's obsession with Mars, which led him to build the Lowell observatory in Flagstaff, Arizona. Lowell maintained that he, too, could see canals on the surface of Mars and through the late 1800s and early 1900s popularised this idea in a series of books. These described an intelligent civilisation, fighting against the dry dying of their planet. This idea remained popular even after the larger telescope at Mount Wilson Observatory showed no sign of artificial construction in 1909. By the 1970s, the first NASA landers, the Viking series, touchdowned on Mars. By then, there was certainly no canals on Mars, and based on the Viking investigations, only a tentative signs of possible life. There have still been some claims that intelligent life once existed on Mars, such as claims that a carved face or pyramids can be seen in photographs. None of these have been shown to be artificial in origin, but the result of natural weathering on the planet. Further missions, such as the Opportunity and Curiosity rovers, have also failed to find conclusive evidence of life on the planet. Although many missions have found signs that may indicate life, such as fluctuating levels of methane and oxygen and evidence of a more humid and temperate climate in the past, none have found conclusive proof. It is looking likely that the first life on Mars will be us.

For decades now, humans have been envisioning human colonies on Mars. From private companies like SpaceX to the European Space Agency, many groups are trying to overcome the various hurdles between us and Mars. The power needed to get there, the resources needed to survive; there are many difficulties facing any human colonisation of Mars. But with such a long history between us and Mars, there is no sign that we will stop trying anytime soon. Although some aims, such as landing people on Mars by 2024, may be purely aspirational, not all are.

Tips for Getting a View of Nebulae

There are thousands of giant clouds floating through our galaxy. Clouds of hydrogen gas mainly, but also water vapor, organic molecules and other compounds. These hazy, nebulous clouds are called nebula and this is how to find some.

First, get somewhere nice and dark with a small to medium telescope. You don't need to go to the middle of nowhere, but outside bright areas will be better.

Secondly, pick some nebulae. Various apps, programs and websites can inform you of the location of nebulae. In the evening for February, Orion's Sword, just below Orion's Belt, is a good hydrogen nebula to start with.

Once you have picked a nebula, find out what it's made of and its color, this information can help[you pick a filter to improve your view. One of the most common filters to put on a telescope is a hydrogen filter, which is particularly useful for observing hydrogen nebulae.

Then, you need to go outside and look! Nebulae are fuzzy and sometimes tough to spot. Photographs can help you to pick out faint nebulae by increasing the contrast of the image after it is taken, but many nebulae are impressive just through the telescope.

After that, try it again! As I said, there are thousands of these nebulae, big and small, dark and bright, red hot or cool blue. If you get into the habit of photographing these majestic space clouds, make sure you send us some of your pictures on Twitter or Instagram!

Website of the month

www.sciencealert.com/space

Science alert takes breakthrough research from peer-reviewed, pre-peer-review and published articles and papers. Their writers distil the content into easy to read pages, broken into topics like space, health and nature. Written from Australia, they are less USA focused than many similar sites.

Quote of the month

Around computers it is difficult to find the correct unit of time to measure progress. Some cathedrals took a century to complete. Can you imagine the grandeur and scope of a program that would take as long?

***SIGPLAN*, Association for Computing Machinery (1992) "Epigrams in Programming", September 1982**

Some Upcoming Events at CIT Blackrock Castle Observatory

Have you ever wanted to see what the Moon looks like through a telescope? Well this is your chance.

Join us at CIT Blackrock Castle Observatory where we'll be checking out our nearest celestial neighbour with FREE telescope viewing sessions.
Observing, as always, is weather dependent.

Sunday 2nd February, 2020 | 4pm to 5pm

Monday 2nd March, 2020 | 4pm to 5pm

PUBLIC OPENING Hours: 10am—5pm (Mon-Sun)

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

Blackrock Castle Observatory is operated by Cork Institute of Technology and is a partnership with Cork City Council.

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