## ASTRONOMY GROUP

We had far-reaching discussions at our meeting in January, ranging from Moon Phases, to how accurate are our calendars, to galaxies colliding. Some presentation information is shown below.

If you are interested in the stars and universe generally, and would like to be involved in interesting discussions, then please come along to our Astronomy meetings, which are held at The Staddy on the fourth Wednesday of each month commencing at 2 pm .

Roy Fairclough


Moon O'Clock 2022
Image Credit \& Copyright: Niveth Kumar
The first Full Moon of 2023 is in the January sky opposite the Sun at 23:08 UTC. Big and beautiful, the Moon at its brightest phase should be easy to spot. Still, for quick reference images captured near the times of all the full moons of 2022 are arranged in this dedicated astro-imaging project from Sri Lanka, planet Earth. The day, month, and a traditional popular name for 2022's twelve full moons are given in the chart. The apparent size of each full moon depends on how close the full lunar phase is to perigee or apogee, the closest or farthest point in the Moon's elliptical orbit. Like the 2022 Wolf Moon at the 1 o'clock position, January's Full Moon occurs within a about two days of apogee. But unlike in 2022, the year 2023 will have 13 full moons that won't all fit nicely on the twelve-hour clock.

## How Accurate Are Calendars?

By Konstantin Bikos
The Julian calendar was abolished because it did not reflect the length of a year on Earth accurately. Today's Gregorian calendar does a better job, but is there such a thing as a perfect calendar?


The time it takes Earth to orbit the Sun defines the length of a year.

## A Year Is Not 365 Days Long

The length of a year on Earth is defined by the time it takes our planet to complete a full orbit around the Sun.

Solar calendar systems, such as the modern-day Gregorian calendar, are designed to reflect the duration of a tropical year-also called a solar year, astronomical year, or equinoctial year-as accurately as possible. This is the duration of a full seasonal cycle, for example, from one equinox to the next. A tropical year is approximately 365.242189 days long on average, though its length changes slightly over time.

Because a common year has 365 days in today's Gregorian calendar, a leap day is regularly added to bring it in sync with the tropical year. Without leap days, our calendar would be off by 1 day approximately every 4 years, causing the astronomical seasons to occur at an increasingly later date as time goes by. In less than 50 years, the March equinox would be in April and the June solstice would occur in July.

## Is There A Perfect Calendar?

The simple answer is no. None of the calendar systems currently in use around the world perfectly reflect the length of a tropical year. However, there are calendar systems that are more accurate than the Gregorian calendar we use today.

The table shows how accurately the different systems reflect the length of a tropical year, sorted from most to least accurate. Calendars that are designed to reflect time spans other than the tropical year are not listed. This includes the Islamic, Buddhist, and Hindu calendar systems.

## Calendar Accuracy Comparison

| Calendar | Introduced | Average Year <br> Length | Approximate Error |
| :--- | :--- | :--- | :--- |
| Persian calendar | 2nd millennium <br> BCE | 365.2421986 days | Less than 1 sec/year (1 day in <br> 110,000 years) |
| Revised Julian <br> calendar | 1923 CE | 365.242222 days | 2 sec/year (1 day in 31,250 <br> years) |
| Mayan calendar | $\sim 2000$ BCE | 365.242036 days | 13 sec/year (1 day in 6500 <br> years) |
| Gregorian <br> calendar | 1582 CE | 365.2425 days | 27 sec/year (1 day in 3236 <br> years) |
| Jewish calendar | 9 th century CE | 365.246822 days | 7 min/year (1 day in 216 <br> years) |
| Julian calendar | 45 BCE | 365.25 days | 11 min/year (1 day in 128 <br> years) |
| Coptic calendar | 25 BCE | 365.25 days | 11 min/year (1 day in 128 <br> years) |
| 365-day calendar <br> (no leap years)* | - | 365 days | 6 hours/year (1 day in 4 years) |



The Colliding Spiral Galaxies of Arp 274
Image Credit: NASA, ESA, Hubble; Processing \& Copyright: Mehmet Hakan Özsarac
Explanation: Two galaxies are squaring off in Virgo and here are the latest pictures. When two galaxies collide, the stars that compose them usually do not. This is because galaxies are mostly empty space and, however bright, stars only take up only a small fraction of that space. But during the collision, one galaxy can rip the other apart gravitationally, and dust and gas common to both galaxies does collide. If the two galaxies merge, black holes that likely resided in each galaxy centre may eventually merge. Because the distances are so large, the whole thing takes place in slow motion -- over hundreds of millions of years. Besides the two large spiral galaxies, a smaller third galaxy is visible on the far left of the featured image of Arp 274, also known as NGC 5679. Arp 274 spans about 200,000 light years across and lies about 400 million light years away toward the constellation of Virgo.

