

Prime Meridian

(133) December 14, 2020

A Christmas spectacular on Dec. 21, 2020 will see the closest approach of Jupiter and Saturn as seen from the Earth since the year 1623. The two planets will appear to merge in the twilight sky.

As the dark months encourage us to look towards the skies, we continue to pioneer our cause for a 21st Century environmentalism that looks beyond the Earth.



A unseasonal glimpse of mid-winter. This festive tree looks remarkably like the famous toadstools *Amanita muscaria*. It is a common sight in local woodland, where it appears in profusion in October. December 2, 2020. New Ash Green, Kent, England.



Above: The Star of Bethlehem gleams out from the tower of St Peter's & St Paul's, Ash, Kent. Dec. 4, 2020.

We cannot give you the Star of Bethlehem - but here is the next best thing.

Its identity has been debated down the years by theologians, historical scholars and astronomers, but today, we shall avoid the temptation to jump into that festive melee.

We can, instead, offer you the chance to witness a close approach between two bright planets, which, it just happens, as this year comes to an end, will occur during the Christmas festivities.

Needless to say, the skies of our latitude have always been something of a lottery and added to that, the global pandemic may curtail many people's movements. The internet, of course, will provide pictures from those who have the opportunity to do so.

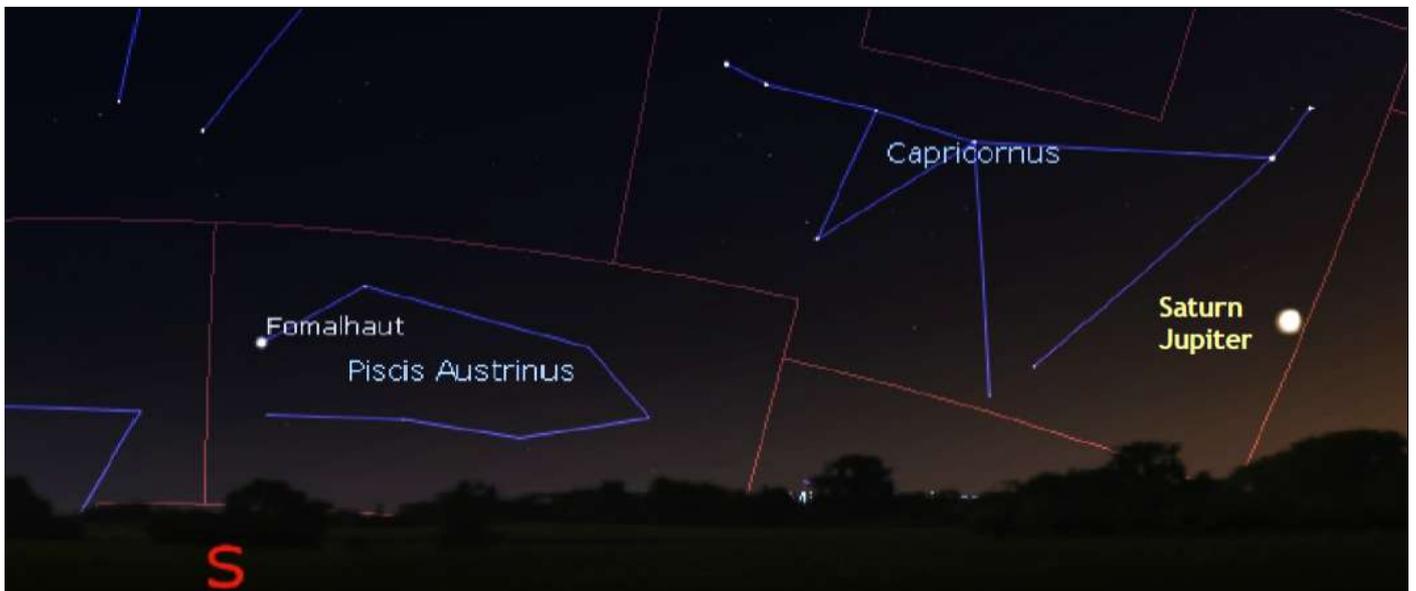
Here on Earth, we see the unfinished troubles of this year, yet there is reason to hope that the challenges and opportunities of 2021 will be surmounted if the leaders and peoples of this planet can rise to the occasion. Everyone of us has a part to play and must not be silent.

Climate activists have recently heard the UK's Prime Minister, Boris Johnson, make the right kind of noises about climate, but he and other world leaders must be seen to act effectively with thoughtfulness, speed and determination. Also, as this newsletter has said, there is a complex Earth Crisis that goes beyond climate alone,

In the spirit of peace on Earth, one can offer to the leaders of nations and campaigns alike, important words that Jesus spoke at the Last Supper. NIV "Luke 22: 25 Jesus said to them, The kings of the Gentiles lord it over them; and those who exercise authority over them call themselves Benefactors. 26 But you are not to be like that. Instead, the greatest among you should be like the youngest, and the one who rules like the one who serves."

Whatever your religious persuasion, or none, may 2021 be good to you.

Best wishes, Editor Martin Heath.



On the evening of the Winter Solstice (Dec. 21, 2020), two gas giant planets will pass so close to each other, as seen from the Earth, that they will seem to the human eye as if they have become a single object. They will be separated by about 0.1 degree.

If we are fortunate and clouds permit, there will be a brief glimpse after sunset before these planets sink below sight. The precise moment of the event will be at 18.20 UTC, with the planets having shortly slid below the horizon as seen from London, UK.

The planets and their systems of numerous moons, will actually be millions of km apart. Here are some facts.

In reality, these huge planets will be nowhere near each other in space. Jupiter, which is 317.8 times more massive and almost 11 times wider than the Earth. Its mean distance from the Sun is 778.57 million km and on Dec. 21, Jupiter will be 5.9 AU from the Sun (an Astronomical Unit is the mean distance between the Earth and the Sun; roughly 149.6 million km). Saturn, over 9 times the width of the Earth and 95.159 Earth's mass has a mean distance from the Sun is 1,433.53 million km. On that date, Saturn will be 10.8 AU from the Earth.

The event will be what astronomers call a "Great Conjunction." Jupiter is close to the Sun and also travelling faster in its orbit. Jupiter circles its orbit in 11.9 years, but has to catch up with Saturn, which has a bigger and slower orbit of 29.5 years. This means that Jupiter takes 19.86 years to overtake Saturn again. On December 21, the Great Conjunction will be special because the two planets will be very close together.

If weather does not permit on Dec. 21, however, there might still be spectacular views in the twilight during the days before and after. On December 16 and 17 the crescent Moon, with its unlit slice caught in Earthshine, will be nearby.

This is what Jupiter and Saturn would look like in close up.

Just after 17:00 UTC, Dec. 21, 2020 (modified from a *Stellarium* image).

Exploring through his primitive telescope, Galileo Galilei (1564-1642) discovered the four largest moons of Jupiter in 1610 (below left). This recognition that astronomical bodies could be orbiting anything other than the Earth required a fundamental re-think about the universe.

Jupiter and its four big moons to the left shows us top to bottom: Callisto, Ganymede, Io and Europa. Upper right shows Saturn to the right. The fainter moon is Rhea (discovered by Giovanni Domenico Cassini, 1625-1712) and the brighter is Titan (discovered by Christiaan Huygen, 1629-1695 in 1655).

The reach of *Homo sapiens* has included Titan and so must its responsibilities.

Spare a thought too for our current understanding that beneath their icy surfaces (except for Jupiter's intensely volcanic moon Io), these huge moons, a few thousand km across, the three Galilean moons and Titan, are expected to have oceans of water at depth. Smaller moons could be of interest also and Saturn's moon Enceladus is spewing out plumes of matter from what may be an internal sea. Some scientists are even wondering whether lakes of methane, ethane and nitrogen, under the dense atmosphere of Titan, might support some kind of exotic life - despite Titan's (for us) deadly temperatures of -179.5°C (94 K), or less.

The Huygens Probe, created by the European Space Agency, and carried to Saturn by NASA's Cassini mission, landed on Titan in January 14, 2005. Other probes are on the drawing board. Astrobiologists are keen to send probes to explore these worlds. For life. As environmentalists, we must ask them to proceed with care. They are not unaware of the problem, but we must speak up to remind them. Unearthly forms of xenobiology would challenge us with particular problems - how could we avoid damaging life forms of kinds we have never met before? In the 21st Century, beyond our urgent need to safeguard our Earth, eco-protection will need a long arm.





Above: The Moon on a puddle in New Ash Green, Kent. November 22, 2020.

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Published by the Ecospheres Project, a research and media collaboration. This newsletter looks outwards from the Prime Meridian. It follows the cycle of the seasons in South East England alongside global environmental issues. At the same time, it steps back to look at the Earth in its astronomical perspective and the search for other habitable worlds, which help us to understand the Earth in its larger context.

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