WEYMOUTH ASTRONOMY

Sky Watcher

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The 21 December brings a rarely viewed 'Christmas Star' which is actually a very close conjunction of Jupiter and Saturn. The BAA has a great article on what to expect.

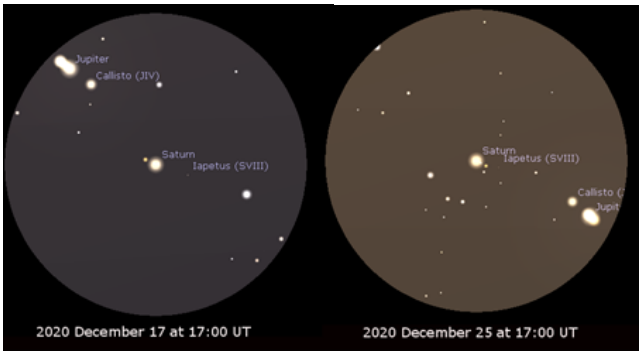
https://britastro.org/node/25245

This separation will reach a minimum on December 21 at 17:00UT. The minimum separation will only be about 6 arc minutes, which is approximately a fifth of the angular diameter of the Moon.

This will be the closest conjunction of these planets since 1623. Such conjunctions occur at a frequency of approximately 19.8 years which is the synodic period between two planets. The last such conjunction was in 2000 and the next will be in 2040.

Wishing you all happy and healthy holidays and best wishes for a bright 2021.

Until next time...SLK



Simulated views of Jupiter and Saturn seen through a 127 mm aperture F10 telescope with a magnification of x50 on December 17 and December 25 at 17:00 UT.

Visitors to both Jupiter and Saturn

by David Prosper

Have you observed Jupiter and Saturn moving closer to each other over the past few months? On December 21, the two worlds will be at their closest, around 1/5 of a full Moon apart! While the two gas giants may *appear* close, in reality they are hundreds of millions of miles apart. Despite this vast distance, a select few missions have visited both worlds by using a gravity assist from giant Jupiter to slingshot them towards Saturn, saving time and fuel.

Pioneer 11 was the first mission to visit both worlds! Launched in 1973, the probe flew past Jupiter in late 1974, passing just 26,400 miles above its stormy clouds. In 1979, it became the first spacecraft to encounter Saturn. Pioneer 11 took the first up-close photos of Saturn and its satellites, and made many exciting discoveries, including the detections of its magnetic field and a faint "F" ring, before departing Saturn and eventually, the solar

The difference in technology between generations of space probes can be stunning! The top two photos of Jupiter and Saturn were taken by Pioneer 11 in 1974 (Jupiter) and 1979 (Saturn); the bottom two were taken by Cassini in 2000 (Jupiter) and 2016 (Saturn). What kinds of photos await us from future generations of deep space explorers?

Trips / Events

Ideas for trips and events always welcome!

Society Meetings cancelled until further notice—Please check their websites for the latest schedule

In the meantime, the British Astronomical Association has moved their meetings to an online format. Live streamed on release and 'catch-up' on Youtube available. These webinars are Open to All.

https://britastro.org/

BAA live webinars, 7pm every Wednesday

https://www.youtube.com/user/britishastronomical

If you are interested in giving a talk or workshop, let the organisers know. They like to offer new titles in their programme line-up.

events@weymouthastronomy.co.uk

WAC Upcoming Events:

	Watch website for online options.
8 Jan 21	10 Min Talks
12 Feb	Prof Carl Murray - Cassini at Saturn
12 Mar	Mark Radice - Observing the Moon

Visitors (more!)

system.

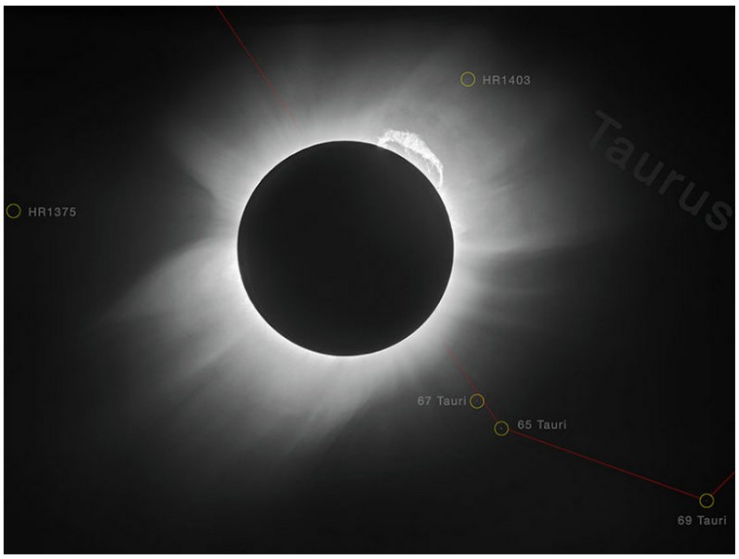
The Voyager missions quickly followed up, taking a "Grand Tour" of the four largest and most distant planets in our solar system. Both probes were launched within two weeks of each other in 1977. Voyager 1 flew past Jupiter in March 1979, discovering Jupiter's faint ring and two new moons, along with active volcanoes on Io's surface! The probe then flew past Saturn in November 1980, discovering five new moons, a new "G" ring, mysterious ring "spokes," and "shepherd moons" shaping the rings. After a brief encounter with Titan revealed evidence of complex organic chemistry and liquid on the moon's frigid surface, Voyager 1 was flung out of the plane of the solar system. Following close behind, Voyager 2 took detailed photos of Jupiter's moons and cloud tops in July 1979. Flying past Saturn in August 1981, Voyager 2 measured the thickness of Saturn's rings and took detailed photos of many of its moons. This second explorer then captured images of Uranus and Neptune before leaving our solar system.

Cassini-Huygens was the last mission to visit both worlds. Launched in 1997, the mission flew past Jupiter in late 2000 and took incredibly detailed photos of its stormy atmosphere and faint rings. Cassini entered into Saturn's orbit on July 1, 2004. The Huygens probe separated from Cassini, landing on Titan to become the first probe in the outer solar system. Cassini discovered geysers on Enceladus, fine details in Saturn's rings, many more moons and "moonlets," the changing oceans of Titan, and seasonal changes on Saturn itself. After revolutionizing our understanding of the Saturnian system, Cassini's mission ended with a fiery plunge into its atmosphere on September 15, 2017.

What's next for the exploration of the outer worlds of our solar system? While Juno is currently in orbit around Jupiter, there are more missions in development to study the moons of Jupiter and Saturn. Discover more about future NASA missions to the outer worlds of our solar system at nasa.gov.

A better understanding of How the Sun bends light

By Damond Benningfield 3 December 2020



A processed image of the 1919 solar eclipse shows stars near the eclipsed Sun. Measuring the positions of these stars confirmed Albert Einstein's new theory of gravity. Credit: ESO/Landessternwarte Heidelberg-Königstuhl/F. W. Dyson, A. S. Eddington, and C. Davidson, CC BY 4.0

In one of the most famous scientific experiments of the 20th century, Sir Arthur Eddington and others carefully watched the solar eclipse of 29 May 1919. Eddington found that the positions of stars that appeared near the eclipsed Sun seemed to have shifted by a tiny amount. The shifts were consistent with predictions from Albert Einstein's theory of general relativity, which showed that a massive object warps the space around it and deflects passing light.

In a new study, *Fokkema and van den Berg* suggest that gravity isn't the only reason light deflects around the Sun or other massive objects. Such objects also refract passing electromagnetic energy, with the amount of refraction dependent on the frequency of the signal.

"The bending of light close to the Sun is an optical phenomenon," Fokkema wrote in an email. Until now, "it was explained by the mass of the Sun and the photon character of light. The bending is then caused by a gravitational tension. In the optical realm, the internal refraction index of the Sun should contribute to the bending."

The researchers compared the propagation of electromagnetic energy using standard ray theory and a new approach based on the theory of geodesics. In the ray model, they say, rays of electromagnetic energy passing near and moving around the Sun or other massive bodies create a "shadow zone." As a result, "the common straight rays of the standard approach cannot image the curvature of the boundary of an object," Fokkema wrote.

The geodesic model, which was confirmed using a 3D numerical simulation of the motions of a wave front around a spherical object, eliminates that problem in part by including the refraction index of the Sun and its contrast with the index of the surrounding vacuum. These quantities define the geodetic line, which determines the path of the light ray with greater precision. This model accounts for an additional deflection of light that is frequency dependent and inversely proportional to the third power of distance, so the deflection becomes more significant at closer distances to the lensing object.

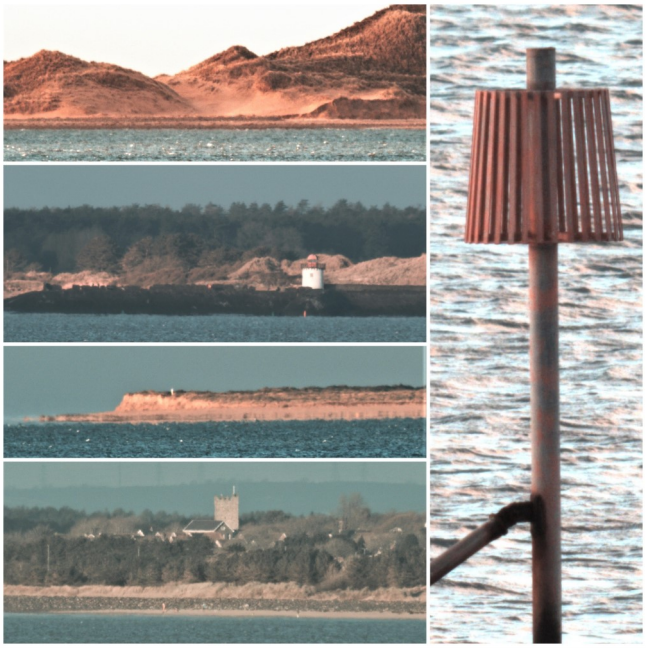
Read the rest of the article at: https://eos.org/research-spotlights/a-better-understanding-of-how-the-sun-bends-light

Citation: Benningfield, D. (2020), A better understanding of how the Sun bends light, *Eos, 101,* https://doi.org/10.1029/2020EO150599. Published on 03 December 2020.

View through my scope...

Recently I've been made aware of a great new capture software called "AstroDMx Capture" which one of the SAS members (Nicola Mackin) has developed. Its been around a while for Linux and Mac, but has just been released for Windows. A quote from Chris Bowden on this software is 'It certainly beats the capture software I was using hands down.'

https://www.astrodmx-capture.org.uk/astronomy/linux-macos-windows/downloads#downloads-current-version



Chris put the software through its paces with a CMOS colour camera (a ZWO AS1642MC) by trying it on terrestrial subjects allowing for excellent capturing of colour images and video of wildlife in the local estuary.

Recently Chris has been enjoying trying out some new and familiar targets with the AstroDMx Capture and the ZWO colour camera. These images were taken over two days - the moon is a composite of 13 images taken with his Meade ETX 80 and assembled in MS ICE. The Horsehead and Ring nebulas were taken with an Altair 60mm refractor using Gimp software to bring out detail hiding in the data.

It is worth checking out Steve Wainwright's blog for more information: https://x-bit-astro-imaging.blogspot.com/2020/12/maintenance-release-for-astrodmx.html?fbclid=IwAR2yOKa-_7A5qD9Nk8CdWFVr9bFhoao5Sqaxg1Gd8U-6adFm_IYNEEb0z_A

AstroDMx Capture is donationware rather than freeware so if you test it and find it useful, please donate to the developer for their hard work on producing this excellent tool.

AstroDMx appears to work well for all sorts of imaging, so should do a great job on solar images too. Eagerly awaiting some clear weather to give this a try. Planning to also test it on an older camera in my kit so hope to give you a full analysis in an upcoming SkyWatcher. ~SLK