



Sun and Planets

As the Earth approaches perihelion, it moves closer to the Sun and the angular diameter of the latter increases from 32'26.4" on 1 December to 32'31.9" on 31 December.

Mercury is too close to the Sun for observation this month.

Venus is getting closer to the Sun. In the beginning of the month it rises about two hours before the Sun and about an hour and a half before sunrise by the end of the month.

Mars is well above the western horizon. In the beginning of the month it sets about three hours after local midnight; as the month-end approaches, it sets about two hours after the midnight hour.

The evening appearance of Jupiter and Saturn is nearly over. In the beginning of the month these gaseous giants are about 2° from each other and set about three hours after sunset. Jupiter is moving towards Saturn.

Transitions of the Sun and Planets

(Disclaimer: we categorically mention here that we do not believe in astrology and believe that the only influence a planet has on us is to give us the viewing pleasure of its beauty. The sole purpose of giving the transition of planets and the Sun is to acquaint the reader with the Indian nomenclature of planets and constellations and also to show that the actual positions of the Sun and planets, which are based on modern computing, are very different from those given in astrology tables.)

List of Events in December 2020

Dt	Dy	Time	Event
01	Tu	13:16	Moon ascending node
03	Th	06:52	Moon north declination: 24.9° N
04	Fr	05:30	Pollux 3.7° N of Moon
05	Sa	06:40	Moon-Beehive: 2.5° S
07	Su	00:13	Regulus 4.5° S of Moon
08	Tu	06:07	Last quarter
08	Tu	11:30	Mercury 4.3° N of Antares
13	Su	02:10	Moon-Venus: 0.8° S
13	Su	02:12	Moon perigee: 361800 km
13	Su	23:30	Antares 5.5° S of Moon
14	Mo	06:05	Geminid shower: ZHR=120
14	Mo	16:33	Moon descending node
14	Mo	21:45	Total solar eclipse
14	Mo	21:47	New Moon
16	We	03:53	Moon south declination: 24.9° S
17	Th	09:58	Moon-Jupiter: 3° N
17	Th	10:55	Moon-Saturn: 3.1° N
20	Su	08:26	Mercury superior conjunction
21	Mo	15:32	Winter solstice
21	Mo	23:50	Jupiter 0.1° S of Saturn
22	Tu	05:11	First quarter
22	Tu	14:30	Ursid Shower: ZHR=10
23	We	20:18	Venus 5.6° N of Antares
24	Th	03:30	Mars 5.1 N of Moon
24	Th	22:02	Moon apogee: 405000 km
25	Fr	05:30	Uranus 3.2° N of Moon
28	Mo	00:30	Aldebaran 4.6° S of Moon
28	Mo	20:33	Moon ascending node
30	We	08:58	Full Moon
30	We	13:23	Moon north declination: 24.9° N
31	Th	11:30	Pollux 3.8° N of Moon

The Sun is in Ophiuchus, the Serpent-Bearer (*Bhujangadhari* or *Sarpdhar*) in the beginning of the month and moves to Sagittarius, the Archer (*Dhanu*) on 18 December.

Mercury moves from Libra, the Scales (*Tula*) to Scorpio, the Scorpion (*Vrushchika*) on 3 December; then to Ophiuchus on 7 December; and then to Sagittarius on 19 December.

Venus is in Libra and moves to Scorpio on 18 December. Then on 22 December it moves to Ophiuchus.

Mars continues its journey in Pisces, the Fish (*Meena*) this month too.

Both Jupiter and Saturn continue on their journey through Sagittarius in the beginning of the month. Saturn moves to Capricornus, the Sea Goat (*Makar*) on 15 December and Jupiter follows on 18 December. Jupiter rapidly closes in on Saturn. On 21 December it will be 0.1° south of Saturn.

March of the Moon

The month begins a day after Full Moon. On 1 December, the 98.7% illuminated lunar disk rises about an hour after local sunset. It passes through the Gateway of Heaven on 4 December. On 6 December, about half an hour prior to local midnight, the Moon and Regulus (*Magha*) can be seen rising almost together. At 00:13 hours they will be within 5° of each other. They will be nearly overhead by sunrise.

On 13 December, Venus will rise about two hours before the Sun, followed by the thin lunar crescent in about 10 minutes. This will be a good photo-opportunity.

On 16 December, by the end of nautical twilight, the thin lunar crescent will be seen above the western horizon, right below Saturn and Jupiter. The next day it will be seen southeast of Saturn. Then on 23–24 December it will pass below Mars. On 27 December the Moon will be between Pleiades (*Kruttika*) and Aldebaran (*Rohini*) and will be 93.7% illuminated.

Geminids Shower

The annual meteor shower 'Geminids' is expected to be active from 4 to 17 December, peaking on 15 December at 06:20 hours IST. The International Meteor Organization's 2020 Meteor Shower Calendar mentions, "This is the one major

shower that provides good activity prior to midnight as the constellation of Gemini is well placed from 22:00 onward. The Geminids are often bright and intensely colored."

You should not miss this shower. There will be no Moon in the sky and there is every chance of seeing faint meteors. These are slow/medium-fast meteors. Their speeds are of the order of 35 km/s.

To observe the shower at its best, look about 30° away from the radiant. Check this article: [Wish Upon a Shooting Star](#). Click on the link, or copy-paste this URL in your web browser:

<https://skytonight.wordpress.com/wish-upon-a-shooting-star/>

Moons of Jupiter (December)

Satellites of Jupiter in December 2020				
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
2	21:13:30	2	<u>Ec</u>	R
2	21:13:12	2	<u>Tr</u>	I
4	20:54:42	2	<u>Ec</u>	R
4	20:59:30	1	<u>Tr</u>	I
6	18:38:36	1	<u>Sh</u>	E
7	20:42:12	3	<u>Tr</u>	I
11	19:03:12	2	<u>Oc</u>	D
12	20:10:54	1	<u>Oc</u>	D
13	19:47:18	1	<u>Tr</u>	E
13	20:33:30	1	<u>Sh</u>	E
20	19:12:24	2	<u>Tr</u>	E
20	19:31:24	1	<u>Tr</u>	I
20	20:11:06	1	<u>Sh</u>	I
21	19:41:42	1	<u>Ec</u>	R
23	19:25:36	4	<u>Tr</u>	I
25	19:52:42	3	<u>Oc</u>	D
27	19:11:12	2	<u>Tr</u>	I
28	18:45:18	1	<u>Oc</u>	D
29	18:51:48	1	<u>Sh</u>	E

The table above gives timings of eclipses, occultations, transits and shadow transits of the moons of Jupiter, suitable for Indian observers. The timings are given in Indian Standard Time (IST).

The output is given as per the following abbreviations and notations:

Columns: **1** = date; **2** = time; **3** = satellite number; **4** = event type; and **5** = phase.

Satellite numbers: **1** = Io; **2** = Europa; **3** = Ganymede; and **4** = Callisto

Event type: **Ec** = eclipse; **Oc** = occultation; **Tr** = transit; and **Sh** = shadow transit.

Phase: **D** = disappear; **R** = reappear; **I** = ingress; and **E** = egress.

Example: an event listed as **2 / 21:13:12 / 2 / Tr / I** means that on 2 December the Satellite Europa transits Jupiter, beginning at 21h 13m 12s IST.

Jupiter-Saturn Conjunction on 21 December 2020

A conjunction of Jupiter and Saturn, also called a '**great conjunction**' will take place on **21 December at 23:50 hours IST**. This will be a very special event. The planets will be so close to each other that we will not be able to see them separately with the naked eye. They will be 06'06" (six minutes and six seconds) of arc from each other. For reference, Alcor and Mizar of Ursa Major, the Great Bear (also known as *Vasishtha* and *Arundhati* of the *Saptarshi taramandal*) are separated by 12 minutes of arc. Sighting of Alcor and Mizar as two separate stars has been considered as a test for good eyesight.

The orbital period of Jupiter is 11.86 years and that of Saturn is 29.5 years. The combined effect of their travel round the Sun is that a great conjunction takes place periodically in about 19 years and 7 months.

At their closest approach during the conjunction, the planets will have set over India. But they will be visible above the western horizon at dusk. The total magnitude will be -2.09.

On 16 December a thin lunar crescent will be seen right below the planets. The next day it will be right above them.

Until 19 December, one can still see the planets separately. Then from 20 to 23 December they will be so close together that the human eye will not be able to distinguish one from the other.

This is the second closest conjunction since the invention of the telescope. On 16 July, 1623, the two planets were just 5'10" from each other.

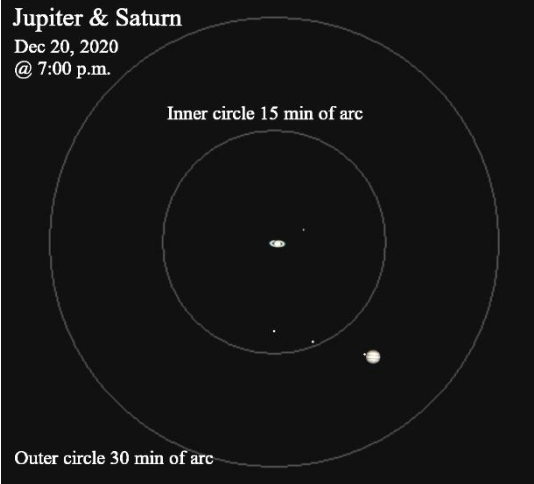
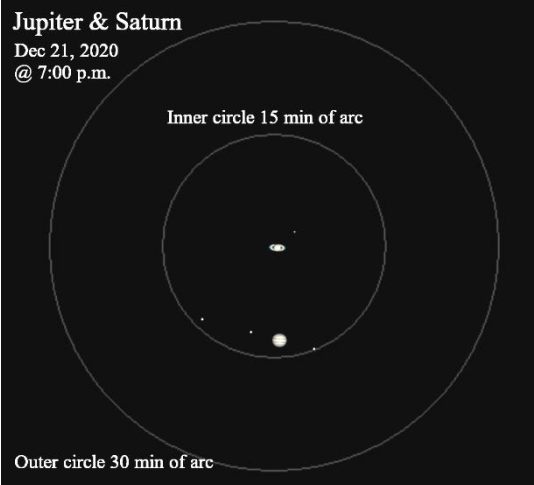
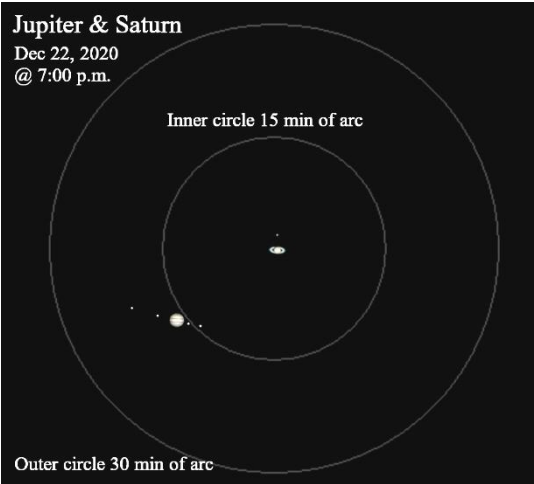
There were two other occasions when the planets were so close that one could not have seen them separately with the naked eye. The first was on 24 October 1682 (separation of 15'25") and the second was on 9 February 1683 when the separation was 11'33". This was because both Jupiter and Saturn were going through retrograde motion almost together.

The planets will again come this close on 15 March 2080 when they will be separated by 06'01".

In 1614, the German astronomer Johannes Kepler determined that a series of three conjunctions of Jupiter and Saturn occurred in the year 7 BC. He argued (incorrectly) that a planetary conjunction could create a nova, which he linked to the Star of Bethlehem. (Source: https://en.wikipedia.org/wiki/Star_of_Bethlehem#Planetary_conjunction).

Professor Karlis Kaufmanis, a professor of astronomy at the University of Minnesota, did considerable research on the Star of Bethlehem in the 20th century. He describes an astronomical event where Jupiter and Saturn appeared together in the constellation Pisces. The occurrence of the event can be mathematically calculated, and it can be found on ancient clay tablet journals from that time, where, according to Kaufmanis, the phrase, 'Jupiter and Saturn in Fish' occurs repeatedly. (Source: <https://sites.google.com/site/astrologicalstarofbethlehem/>)

Jupiter and Saturn on 20, 21 and 22 December at 7 pm IST

<p>Jupiter & Saturn Dec 20, 2020 @ 7:00 p.m.</p>  <p>Inner circle 15 min of arc</p> <p>Outer circle 30 min of arc</p>	<p>20 December 2020</p> <p>Separation between Jupiter and Saturn is 10'07"</p> <p>Saturn's satellite Titan is visible on the upper right of the planet</p> <p>Jupiter's satellites Calisto, Ganymede and Io are visible from left to right of Jupiter</p> <p>Europa is transiting with egress at 19:12:24</p>
<p>Jupiter & Saturn Dec 21, 2020 @ 7:00 p.m.</p>  <p>Inner circle 15 min of arc</p> <p>Outer circle 30 min of arc</p>	<p>21 December 2020</p> <p>Separation between Jupiter and Saturn is 06'15"</p> <p>Jupiter's satellites (from left), Calisto, Ganymede and Europa are visible</p> <p>Io reappears from eclipse at 19:41:42</p>
<p>Jupiter & Saturn Dec 22, 2020 @ 7:00 p.m.</p>  <p>Inner circle 15 min of arc</p> <p>Outer circle 30 min of arc</p>	<p>22 December 2020</p> <p>Separation between Jupiter and Saturn is 08'08"</p> <p>All four satellites of Jupiter (from left), Calisto, Europa Jupiter, Io and Ganymede are visible</p>

