OBSERVATION OF THE MOON PHASES AND RELATIONS WITH THE SUN APPROXIMATE DETERMINATION OF THE SITUATION

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Abstract. This article describes a method for organizing practical lessons in astronomy based on the Stelliryum program, making observations, in particular, an in-depth study of planetary motion. This method can be used by teachers, students and schoolchildren interested in teaching. astronomy.

Keywords: almagest, deferent, epicycle, moon, mercury, venus, mars, jupiter, saturn, algorithm, ecliptic, geocentric, heliocentric.

The Moon is the Earth's natural satellite and revolves around the stars for 27 to 32 days, which is called the Sideric period. The rotation of the moon around the Earth depends on the direction of the Earth's rotation around its axis and in orbit. Its orbital speed is 1.02 km / s, which is 130 times faster than that of the stars. The moon is illuminated by sunlight, and we see that illuminated place. Especially at night, its illuminated area reflects the sun's rays from the horizon like a mirror, illuminating the Earth.
The moon's orbit is 363,400 km along the ellipse and 405,400 km at its apogee. The Moon's orbit is 509 degrees with the ecliptic, and it crosses the ecliptic plane twice in a year, causing a number of events. Because the Moon's orbital plane is so close to the ecliptic plane that it orbits the Earth between the Sun and the Earth, its illuminated side is invisible to the Earth for some time. This is called the new moon phase (Figure 1).

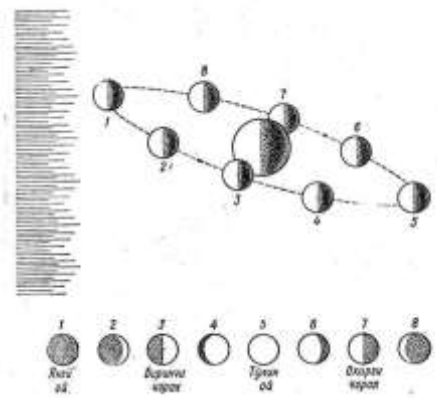

Figure 1. Change of phases of the moon

Below are the corresponding cases of the Moon appearing to the observer in the sky:
New moon phase. (Invisible 1-2 days).
Living phase. (2-3 days).
The first quarter phase (the moon appears in a semicircle).
Moves from state 4 to state 5.
In case 5, the full moon phase (the moon appears in a full circle. As the sun sets in the west, the moon rises in the east).
7. The last quarter phase (the moon is semicircular).
8. The last phase. (Then comes the new moon). It is called the old moon [1].
The complete change in the lunar phase is repeated every 29.53 days.1 Figure 1 and 2 show the Moon's orbit around the Earth. The sun's rays fall almost parallel to the moon's surface. (Figure 1 shows the sun's rays on the left and Figure 2 on the right).

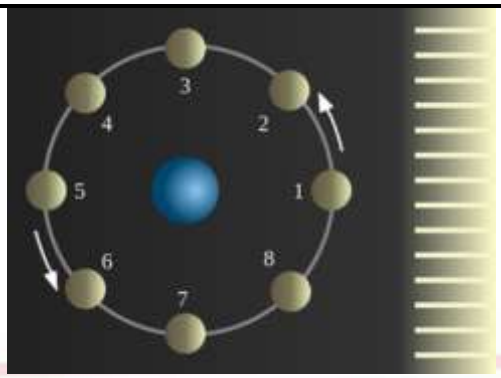

Figure 2. The sun's rays fall parallel to the moon from the right

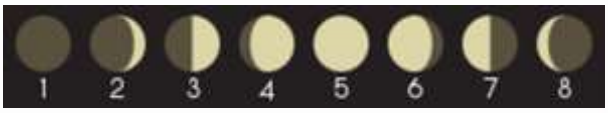

Figure 3. View of the Moon's phases from the Northern Hemisphere to the observer

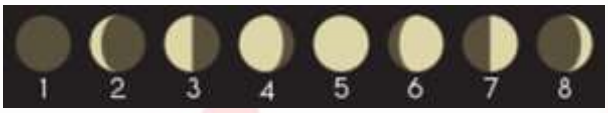

Figure 4. The phases of the moon are shown to the observer from the southern hemisphere

If you look closely, case 2 is replaced by case 8.

Figure 5. This image shows the phases of the Moon as the observer observes the Earth's equator. [1]

After the students are introduced to the phases of the Moon, they can learn the observational lessons from the sky. Such observations can be made in September, October, November. Pre-plan a follow-up plan based on the Stellarium program, schedule the phases of the new moon, young moon phases, 1st quarter, full moon, and full moon, and distribute it to students, even if they are given the task of independent observation. They are asked to draw pictures of the phases of the Moon on the dates in the table. In astronomy, it is best to have students talk to them about the results of their observations in class or in repetition classes. The following is an example of such a table for September, October, and November, 2022. For the Northern Hemisphere, the phases of the Moon are observed as shown in Figure 3.

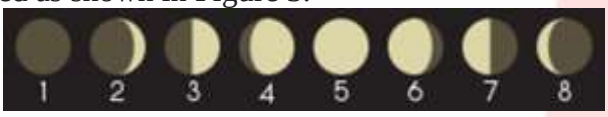

Figure 3. The phases of the Moon shown in Figure 3 with respect to the Uzbek horizon

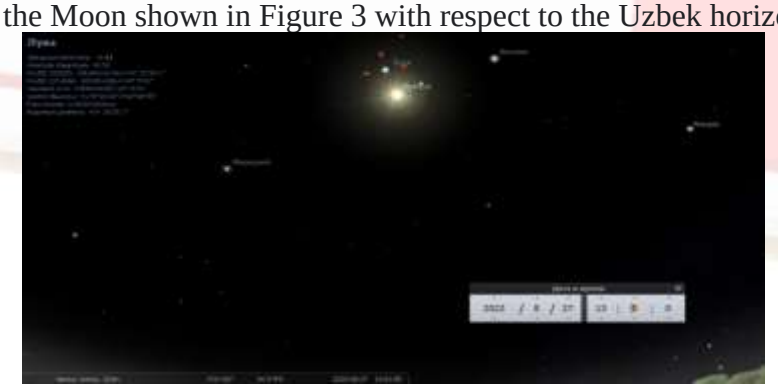

Figure 6. The Moon passes by the Sun. New moon. (Phase 1). Shown in the table

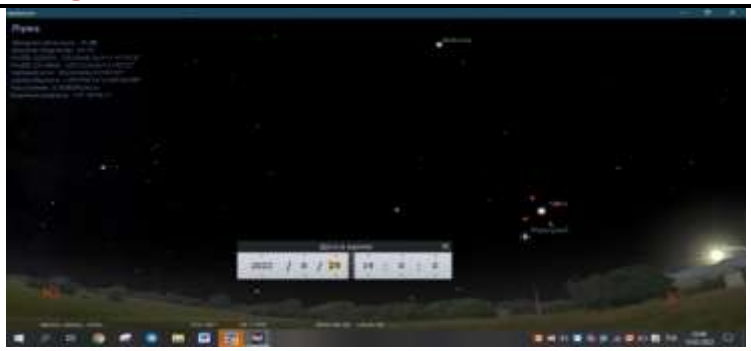

Figure 7. A 2-day appearance of the Young Moon as the sun sets in the west(Phase 2)
It is visible from the west at sunset. The planet Mercury is also visible next to it. On the date shown in the table

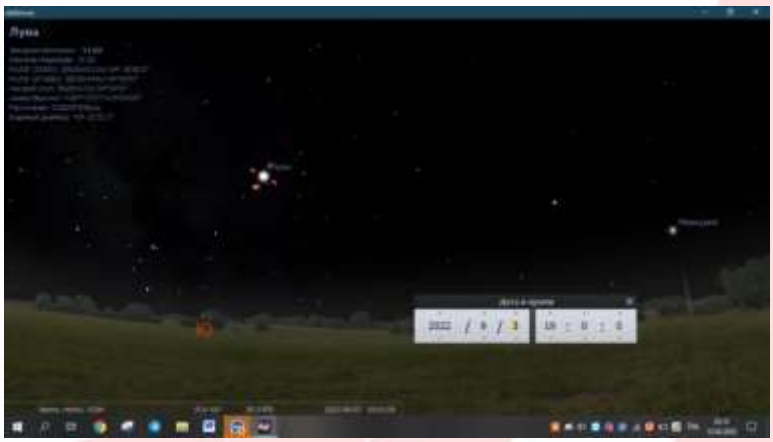

Figure 8. The moon is visible to the south at sunset. (Phase 3)
This is the first quarter. The moon appears in a semicircle.

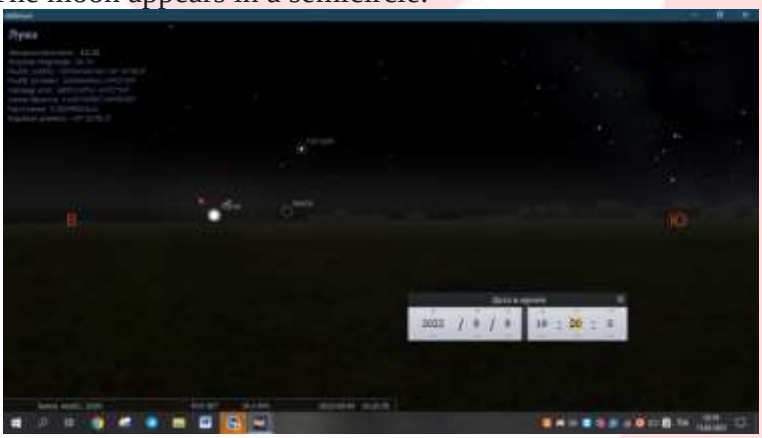

Figure 9. Full moon in the east as the sun sets in the west(5-phase)

As the sun sets in the west, the moon rises in the east. Throughout the night, the moon appears in a full circle in the sky, culminating in the sunset in the morning.

Figure 10. The moon is in the last quarter (phase 7)

In the morning, when the sun rises in the east, the moon appears in a semicircle in the south. Mars is also visible next to it.

Figure 11. The moon enters a new lunar phase (phase 1). [4]

The moon is next to the sun. The planets Mercury and Venus are not visible in the background of the Sun.

So, in conclusion, the sidereal and synodic periods of the Moon can be observed in the sky for 1 month to study the phases of the Moon. Practical observation in the classroom can be planned in advance with the help of the Stellarium program, and it is advisable if it is based on a discussion with the student.

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