

# The Effectiveness of the Use of Computer Programs in the Organization of Practical Training in Astronomy.

**Z. A. Avezmuratova,**

Teacher of the "Interfaculty General Engineering Sciences"  
department of UrSU,  
PhD supporting doctoral student

**Abstract:** In this paper presents the observations at the practical lessons, particularly on the Internet and the Stellarium programs, including visual observation of the planet Mars and its surface movement. This method are useful for a teachers, students and interesting persons.

**Key words:** Ecliptic, Jupiter, Polaris, Sirius, Fomalhaut, Aldebaran, Zodiac, Fish, Aries, Taurus, Twins, Cancer, Lion, Virgo, Scales, Scorpion, Sagittarius, Capricorn, Aquarius, constellations of the Zodiac, Moon, Sun, Stars, Orbit, Great confrontation, Ellipsis, Culmination, Surface, Observatory, East, South, West, North, Horizon, programs "Stellarium".

Even 5 thousand years ago, people observed that the 5 planets move differently from the stars. It is especially pleasant to watch the planets Venus, Jupiter and Mars shining in the sky. In previous topics, we have provided information about studying the movement of the planets using the Moon. Below is one of the practical observations, i.e., the method of visual observation of its opposite (opposite) moments and oscillating movement by observing the planet Mars. It is known that the planet Mars (Mirrix) is the closest neighboring planet to the Earth from the outside. It goes around the Sun through its orbit, and because the orbits of the planets are ellipses, it is at different distances from the Earth.

It can be from 400 million km at the time of approach to 55 million km when it comes closest to the Earth. Mars approaches Earth every 780 days. This situation is called facing. If the Earth's tropical year is 365.2422 days, it repeats every 2 years and 50 days. At this time, the Earth will be between Mars and the Sun. Favorable conditions for observing Mars occur, firstly, during such periods, Mars is very close to the Earth, secondly, it appears to the Earth as a full circle (similar to the full Moon) turned to the Earth with its illuminated side, and thirdly, the Sun is set. It comes out of the east in the early evening, reaches a high peak at midnight, and sinks to the west near morning.

That is, it is visible on the horizon all night long. In this case, Mars (also other planets) moves like a gypsy. Among such oppositions, especially in cases where the perigee of Mars and the perigee of the Earth are close, Mars comes close to the Earth up to 55 million km. Such confrontation is called "The Great Confrontation". Such a situation is repeated in 15-17 years, and because it is interesting, many astronomers have been interested in observing it. Currently, the whole world is interested in the planet Mars. In the USA, Russia, Japan, China and other developed countries, astronomical observatories, astronomical organizations are working on the observation, study and mastering of Mars in the coming years, about 2025-2040. Of course, in the implementation of such plans, it is important to study the moment of facing Mars. Because Mars is closest to Earth at the moment of opposition. In continuous education, students get acquainted with basic astronomical concepts in elementary grades in natural sciences, in 6-8 grades in physical sciences.

"Astronomy" is taught in 11th grade in general secondary schools, in 3rd year of KHM and Academic Lyceum. Students majoring in "Physics", "Physics and Astronomy" in higher education receive theoretical knowledge in "Astronomy and Astrophysics". Consolidation of acquired theoretical knowledge through practical observations is highly effective in increasing students' interest in astronomy. Below we present a method of observing the opposition of Mars in local conditions.

1. First of all, we will find Mars among the luminaries of the sky using the Stellarium program. To do this, we use the apparent motion of the Moon (as shown in Topic 6). Everyone can find the moon in the sky without getting lost. The moon revolves around the stars in 27.32 days. Since the plane of rotation of the Moon is 509' in relation to the plane of the ecliptic, and that of Mars is 108', they move

close to the sky and meet (approach) once every 29.53 days (the synodic periods of the Moon). The date for this is given in the observation chart, and on this date the red, yellow luminary next to the Moon will be Mars. To clarify it, if it is observed for 2-5 days, it can be felt that it moves relative to the stars next to it.

2. The last "Great Confrontation" of Mars was on July 27, 2018, and the next "Great Confrontation" will take place on September 15, 2035. Between this period, on October 714, 2020, and on December 8, 2022, and so on, there will be 7 ordinary confrontations. The given table shows the dates, the elevation of Mars to the plane of the celestial equator, its distance from the Earth, and its approach to the Moon with other planets and other celestial bodies on or near the indicated date. Each teacher can make such a schedule at the beginning of the school year and can assign assignments to students or conduct joint observations on the dates specified in it.

3. Since the opposition is taken with respect to the Sun, certainly on the specified date, Mars will cross the sky meridian plane where the observer is standing at midnight, that is, at 0 o'clock, and will be at a high culmination. Each observer should know the meridian plane (that is, P- north pole, Z-zenith and S-horizon passing through the south point) for his place. As mentioned above, this happens exactly at 2400 or 0 hours of midnight, and if there are moonless nights, the red planet will look very beautiful. If this is the case with the Great Confrontation, then it will be even more obvious, with a visual diameter of 25". Even better results can be achieved if binoculars, telescopes, small school telescopes are used for observation. The result will be even better if you make an observation schedule based on the Internet or the Stellarium program and observe Mars one or two months before the observation date. The table shows the passage of the Moon by the side of Mars with the date of one and two previous months.

If it is observed 2 months before and 2 months after the date of opposition of Mars, it is also possible to clearly observe its movement. When the configuration of the planets is studied, the outer planets move like a pendulum during the periods of opposition. Similarly, Mars usually moves from west to east relative to the stars. 2 months before the opposition, Mars begins to move from east to west, changing its direction of motion relative to the stars near it, and after 2 months after the opposition, it resumes its previous movement and continues from west to east. and continues until the next face-off. During the period of transit and opposition, Mars is in one of the constellations of the Zodiac. On October 14, 2020, it will be between the constellations of Hut and Hamal. With this, the position of the Zodiac constellations in the sky can also be studied by visual observation. Of course, if the results of such observation are discussed with pupils and students, it will have a good effect. Below is an example of a pre-planned observation schedule for Tashkent time based on the Stellarium program and internet materials.

Sample table

№	Facing date	Constellation	Distance between Earth and Mars (mln. km)	The date of the conjunction of Mars with the Moon
1.	27.07.2018	Jaddi	57.36	27.07.2018 20:00
2.	14.10.2020	Hut	62.43	02.10.2020 20:00
3.	08.12.2022 Soat:24:00	Savr	81.95	08.12.2020 18:00
4.	16.01.2025	Javzo	95.8	13.01.2022 18:00
5.	19.02.2027	Asad	101.02	19.02.2027 21:00
6.	25.03.2029	Sunbula	96.7	02.03.2029 21:00
7.	04.05.2031	Mezon	83.29	10.04.2031 05:00
8.	27.06.2033	Qavs	63.62	15.06.2033

				00:00
9.	15.09.2035	Dalv	57.04	21.08.2035 00:00

The table shows the movement and opposition of Mars in the constellations for some dates through pictures. Observations can be used to compare the position of the sky using these images.



Figure 1. Mars in the constellation of Saurus (Telets)

The planet Mars, moving from west to east in relation to the stars like other planets, will begin to move from the Hamal (Aries) constellation to the Saurus (Telets) constellation at the beginning of August 2022. It is visible in the morning in the South-Eastern part of the sky. The Moon will also come to him on that date. In the next case, it begins to move towards the horn of Sauvry



Figure 2. Mars is in the constellation of Saurus (Telets)

The planet Mars continues its direct movement (from west to east) and moves in the constellation of Saurus (Telets). On that date, it will be visible with the Moon in the morning in the southern part of the sky.



Figure 3. Mars is in the constellation of Saurus

If you look carefully at the picture, Mars is in the horn of Saurus and is moving to the constellation of Javzo (Bliznetsy). But from the beginning of November 2022, Mars will start to move in reverse (from East to West). See the next picture.



Figure 4. Mars is again in the constellation of Saurus (Telets)

If you look carefully at the picture, after more than a month, on December 12, Mars will return to the constellation of Saurus (Telets). On this date, in the middle of the night, at 00:26 hours (Uzbekistan time) for the Urganch region, Mars crosses the meridian line. This is the position of facing Mars. The figure shows the meridian line of the observation point.

Summarizing this topic, it can be said that:

1. The planet Mars moves in the constellation Saurus from August 2022 to March 2023, i.e. for 6 months.
2. During this period, on the night of December 12-13, 2022, at midnight, the planet Mars will face the Earth, that is, it will come closest to the Earth.
3. In the outer planets, including Mars, a state of opposition is observed during its spiral motion.
4. The outer planets come closest to the earth during their orbital motion.
5. During 780 days (synodic period), Mars moves only once as a periscope and stands opposite.
6. As mentioned in the text above, for example, to fly to the planet Mars, its motion and facing position are chosen.

By explaining these results to students, it is possible to further increase their interest in science.

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