

Evidences that the Earth is not flat, but round

I am sure that you are more than convinced that the Earth is not flat, but round if you have been reading all this so far. But, let me briefly summarize some evidences and add some more.

During partial lunar eclipses, we can see the shadow of the Earth on the Moon. The shadow is round, as the Earth is round. On the other hand, according to the Flat Earth theory, a lunar eclipse is caused by an object near the Sun, which shadows the Moon. It might be true that such an object indeed exists, but nobody has seen it. The Flat Earth believers fail to draw the right conclusion from the fact that lunar eclipses occur only during the full Moon.

Also, the Flat Earth theory cannot explain why some Southern stars are not visible at places located northern enough, and why some Northern stars are not visible at places located southern enough.

The Flat Earth believers also believe that the Earth doesn't move, but all the other celestial objects move instead. However, it is clear from the Foucault pendulum that the Earth rotates. Many have performed the Foucault pendulum experiments, and they all confirmed the rotation of the Earth.

There is another perspective to see the Foucault pendulum. Even though we didn't mention it before, there is a force called "Coriolis force," which is present when an object moves in a rotating frame. The French scientist Gaspard-Gustave de Coriolis mathematically showed the existence of such forces and calculated their magnitudes and directions. As the Earth is rotating, Coriolis force is also present on the Earth, if you are moving. The Coriolis force acts rightward in the moving direction on the Northern hemisphere, and leftward on the Southern hemisphere. From the Coriolis force perspective, the Foucault pendulum rotates, because the pendulum receives the Coriolis force as it is moving, i.e., oscillating back and forth. Coriolis force is also important in studying weather because that's how the winds, such as the ones in typhoons, curve. It goes without saying that there is no satisfactory explanation for such a phenomenon in the Flat Earth model. The weather forecast would be impossible in the Flat Earth model. The Coriolis force is also important in firing the missiles. Without considering the Coriolis force, the missiles miss the target.

We have also mentioned that seamen in the late 18th and the first half of the 19th century used the lunar distance method to determine the longitude of their positions on the sea. When the seamen calculated the apparent position of the Moon, they had to take into consideration of the Moon's parallax which could be as big as 1 degree. If the Moon were really approximately 3,000 miles (5,000 km) away, as the Flat Earthers believe, instead of 240,000 miles (380,000 km) away, the parallax they would have had to take into account would be much bigger, up to 60 degrees. If the Flat Earth theory were correct, the seamen's calculation of their longitude would not agree with their actual longitude at all. The tables of the Moon's position published by the Royal Greenwich Observatory, which were accurate up to a quarter arcminute, would have been totally useless.



Fig. 1: Sunrise or sunset

Another nonsense that the Flat Earth believers believe is that the Sun never sets. They believe that the Sun is not below the horizon during the night, but still above the horizon, albeit sufficiently far away so that the sunlight is so dark. Anyone who has seen the sunrise or the sunset can see the fallacy of their argument very easily. If you have the sunrise or the sunset, you must have seen scenery like Fig. 1 where the lower half of the Sun is below the horizon. It's a scenery they can never explain. If the Flat Earth theory is correct, the lower half of the Sun must always be visible, as long as the upper half of the Sun is visible, unless the lower half is blocked by a mountain or a hill. However, I did see scenery like Fig. 1 on TV. In that case, the horizon was at sea. There was neither a mountain nor a hill that would block the lower half of the Sun. Only, the sea itself blocked it.

Let me mention another serious problem with their model. According to them, the North Pole is at the center of the Flat Earth disc, and the South Pole is at the edge of the Flat Earth disc bounded by a giant wall. They say that, at the summer solstice, the Sun is above the Northern Tropic (the latitude 23.4°N), and at the winter solstice, the Sun is above the Southern Tropic (the latitude 23.4°S). And at equinoxes, the Sun is above the equator. See Fig. 2.

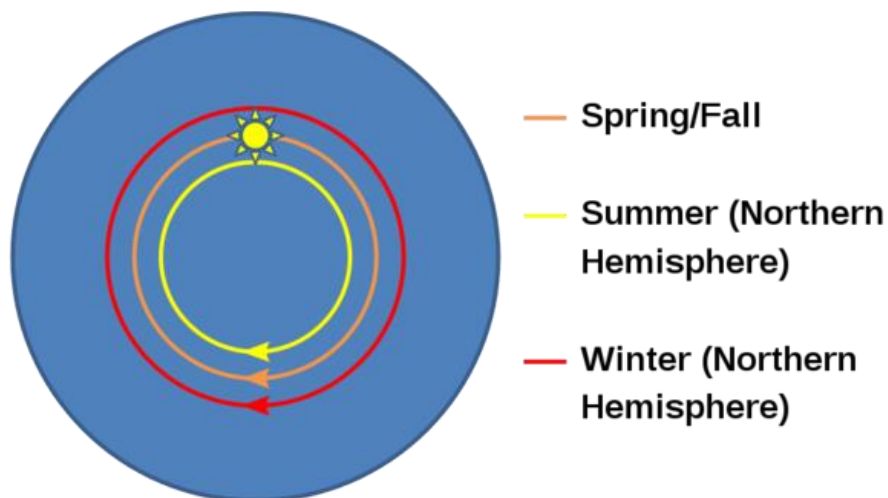


Fig. 2: The Flat Earth explanation of seasons

This sounds plausible, but if you actually think about it, you see how wrong they are. Let's try to determine how high the Sun is in their model. Remember that the Sun's altitude seen on the equator during solstices is $66.6^\circ (=90^\circ - 23.4^\circ)$. Therefore, the Sun's position should be something like Fig. 3. N denotes the Northern Tropic, E denotes the equator, and S denotes the Southern Tropic. You see that the angle between the lines connecting the Sun's two positions at noon at the two solstices is $46.8^\circ (=23.4^\circ + 23.4^\circ)$. If you remember our earlier article, "Why does the season change?," this angle must be the same for any other points, as long as the Sun is visible (i.e., not below the horizon) during the two solstices. However, at other points, this should be less than 46.8° according to their model. See Fig. 4. According to the Flat Earth Model, no matter where you choose A except the equator, θ must always be less than 46.8° . My quick calculation shows that θ can be as small as 20.4° at the Polar Circles.

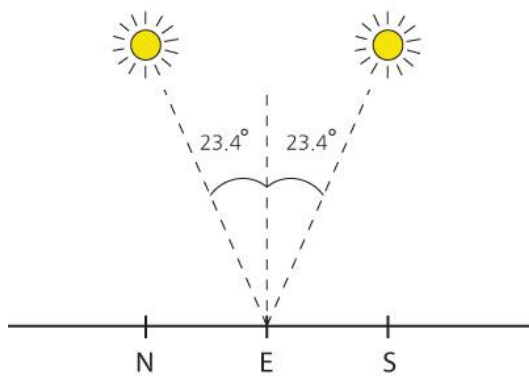


Fig. 3: The Sun's position according to the Flat Earth Model

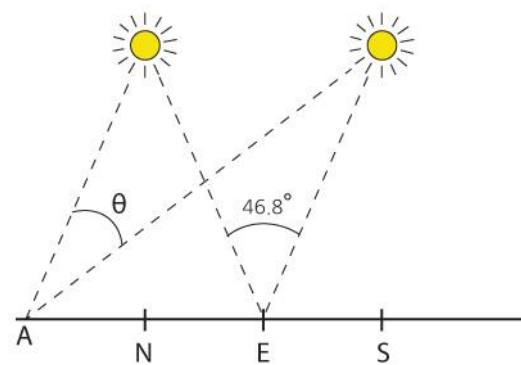


Fig. 4: Fallacy of the Flat Earth Model

If the Flat Earth Model is indeed true, people would have already noticed that θ is less than 46.8° , as long as θ is not measured at the equator. However, nobody obtained a value less than 46.8° for θ . For example, in our first article on the history of astronomy, we have seen that the Chinese measured θ to be 47.4° in the Han dynasty period.¹ Considering the position where θ was measured (i.e., the latitude 34.9°N), I obtained that the Flat Earth model would predict that θ should be about 35° . The Chinese measured this 2,000 years ago, when they didn't have modern technologies, but certainly their technology was not bad enough to measure the angle incorrectly by 12 degrees.

¹ I already mentioned there that the difference is due to the fact that obliquity oscillates slowly over time.

The Flat Earth believers complain of the NASA conspiracy; they say that NASA fabricated the photograph of the Earth, and so on. I think if they are serious, they should also complain of the ancient Chinese conspiracy 2,000 years ago. The problem is that there must be also the ancient Indian conspiracy, the medieval Arabic conspiracy, and so on if the ancient Chinese conspiracy was indeed true. If you are interested in the historical values of the obliquity of the ecliptic see [1]. None is smaller than 23.4° .

When I pointed out this "ancient Chinese conspiracy," a Flat Earth believer noted that the ancient Chinese had believed in the Flat Earth, yet they correctly predicted the solar and lunar eclipses. That is true, but it's only because the ancient Chinese correctly believed that the Sun and the Moon rise and set. The ancient Chinese didn't know the fact that a part of the Earth could be a night when the other part of the Earth was a day, so it was possible to make a Flat Earth model that could predict the eclipses correctly. However, today, even the stupidest among the stupid Flat Earth believers, who claim that Australia doesn't exist, do not deny the fact that a part of the Earth can be a night when the other part of the Earth is a day. Then, they are forced to make up a model in which the Sun and the Moon never set, otherwise, the whole part of the Earth will be a night simultaneously after a sunset. Then, their model constrains the Sun and the Moon to be very close to the Earth, their distances from the Earth being smaller than the size of the Earth. Otherwise, the very fact that one part of the Earth can be pitch dark while the other part of the Earth is very bright won't be possible. As the Sun and the Moon are very close to the Earth, they fail to make correct eclipse predictions or any other celestial predictions such as the time of sunrise or sunset. As they cannot come up with a model that correctly predicts all these celestial times, they cannot agree with themselves. Therefore, some say the Sun is 30 miles (50 km) above the Earth and others say 5000 miles (8000 km) above the Earth. By the way, if Fig. 3 is correct, the Sun is about 3700 miles (6000 km) above the Earth.

[1] Wittmann, A. (1979). "The Obliquity of the Ecliptic". *Astronomy and Astrophysics*. 73 (1–2): 129–131.

Summary

- During partial lunar eclipses, the shadow of the Earth on the Moon is round. This shows that the Earth is round.
- The Flat Earth model cannot explain why Northern stars are not visible at places located southern enough, and why Southern stars are not visible at places located northern enough.
- The Flat Earth model, according to which the Sun never sets, cannot explain the scenery we see during a sunset or a sunrise. If the Sun never sets, it would be impossible to see

the lower half of the Sun is covered by the sea horizon.

- The Flat Earth model cannot explain why we consistently get the same value for the obliquity of the Earth no matter where we measure it.

Fig.2 is from https://wiki.tfes.org/Flat_Earth_-_Frequently_Asked_Questions