**Both the Sun And the Earth Are Fixed Stars**

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**Abstract**

The heliocentric model well explains the sunrise, sunset and the changes of four seasons. However, this model cannot explain why the direction of a constellation changes with the seasons, and why the same stars can be observed all the year. It is a simple fact that the solid angle of the sky observed on the earth at night is only 0.005 degrees. Based on this fact, the earth can only be fixed on the side of the sun, and its axis rotates about an axis perpendicular to the ecliptic plane. This can explain why the direction of the Big Dipper observed on the earth rotates with the change of seasons, and why some stars can be observed on the earth all year round.

As long ago as 340 B.C. the Greek philosopher Aristotle thought that the earth was stationary and that the sun, the moon, the planets, and the stars moved in circular orbits around the earth. This idea was elaborated by Ptolemy in the second century A.D. into a complete cosmological model. After more than a thousand year, a different model was proposed in 1514 by a Polish, Nicholas Copernicus. His idea was that the sun was stationary at the center, and that the earth and the planets moved in circular orbits around the sun. Nearly a century passed before Copernicus’ idea was taken seriously. Until 1609, the Italian, Galileo Galilei found that, with a telescope, the planet Jupiter was accompanied by several small satellites that orbited around it. This implied that everything did not have to orbit directly around the earth, as Aristotle and Ptolemy had thought. An explanation was provided much later, in 1687, when Sir Isaac Newton published his Philosophiae Naturalis Principia Mathematica *(1)*. Newton postulated a law of universal gravitation according to which each body in the universe was attracted toward every other by a force that was stronger the more massive the bodies and the closer they were to each other. Newton went on to show that, according to his law, gravity causes the moon to move in an elliptical orbit around the earth, and causes the earth and the planets to follow elliptical paths around the sun. By then, the heliocentric model had been perfected. Although Einstein’s general theory of relativity predicted a slightly different motion from Newton’s theory, it has been universally accepted that the earth travels around the sun in an elliptical orbit for more than four centuries.

Although the sunrise, sunset and four seasons can be explained by the heliocentric model, it cannot be explained with this model that the constellations, such as the Big Dipper, observed on the earth change their directions with the change of the seasons *(2-4)*. Because the fixed stars are relatively static, the rotation of the fixed stars observed on the earth must be caused by the change of the observer's observation direction. For example, the directions of the Big Dipper observed on the earth are different in different seasons, as shown in Fig. 1.

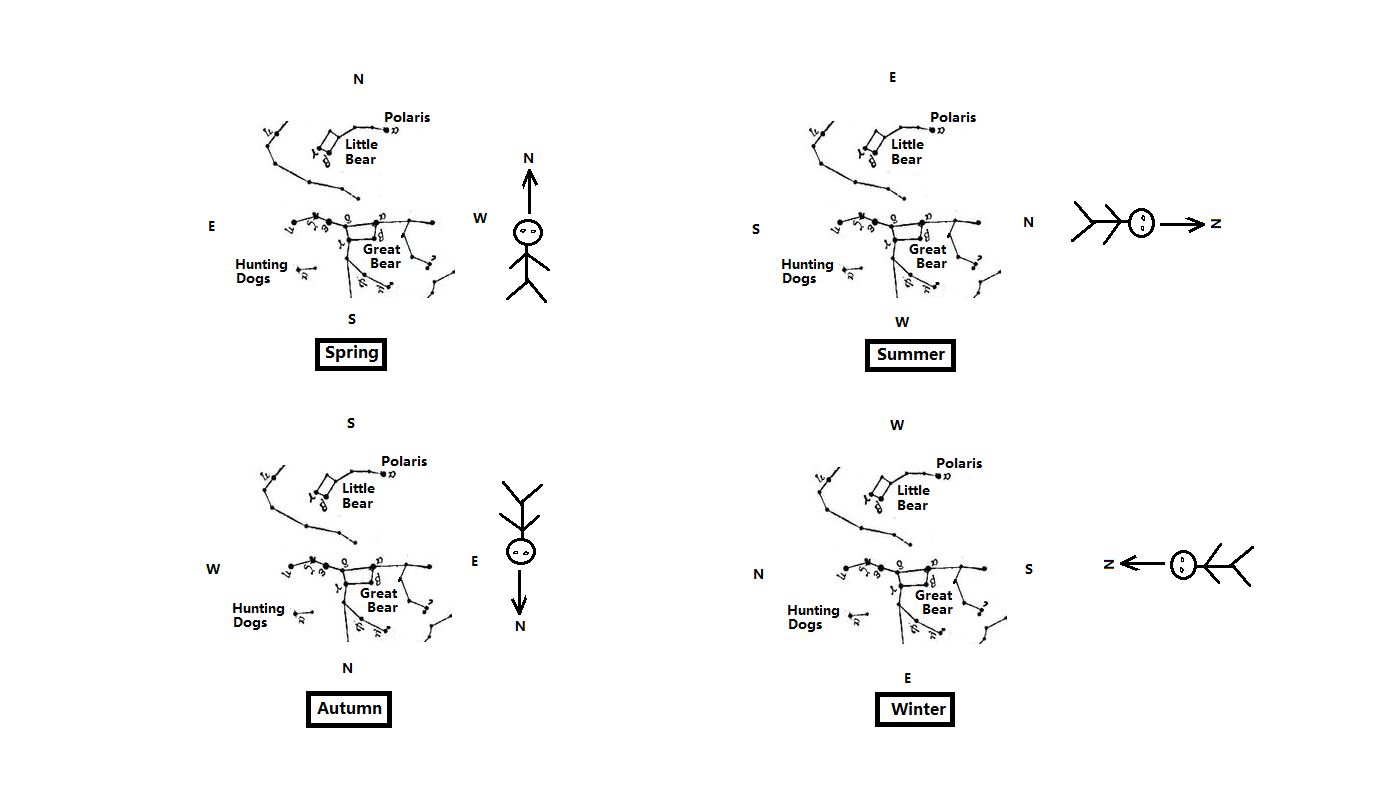


Figure 1 The directions of the Big Dipper are unchanged, which look changed just because the observation direction has changed.

According to the heliocentric model, when the earth revolves around the sun, the direction of its axis remains unchanged, and its north pole always points to Polaris. Obviously, the heliocentric model cannot explain the rotation of the Big Dipper observed on the earth. This leads to the second problem. If the earth revolves around the sun, why can the Big Dipper be observed all year round? Because the sun's light is too strong, it can only be observed when the sky is away from the sun. In other words, only the area of sky within the solid angle θ can be observed from the earth at night, as shown in Fig.2. The distance between the earth and the sun is D=149,597,870km, and the radius of the earth is RE=6371km. So, the solid angle θ of the sky observed on the earth can be calculated as follows,

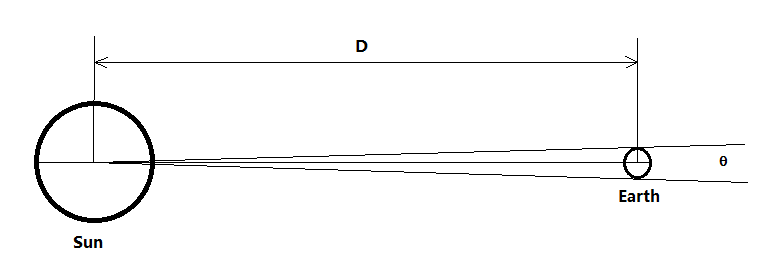


Figure 2 The solid angle of the sky observed on the earth

According to the heliocentric model, in spring and autumn, as well as summer and winter, the direction of observing the stars on the earth is diametrically opposite, as shown in Fig.3. Therefore, it is impossible to observe the same stars in spring and autumn. The same is true in summer and winter. Even in two adjacent seasons, such as mid spring and midsummer, it is impossible to observe the same stars, because the solid angle of the sky observed on the earth is only 0.005 degrees.

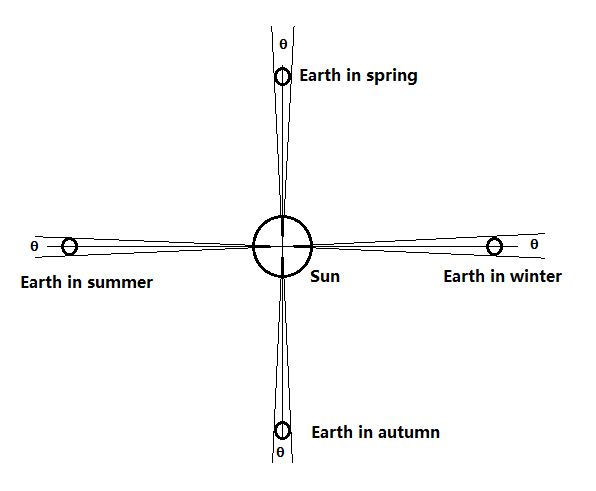


Figure 3 Earth position around the Sun in mid-spring, midsummer, mid-autumn, and mid-winter.

Therefore, the sky observed on the earth all year round is within the same solid angle. Only when the earth is fixed on the side of the sun can the sky observed throughout the year be within the same solid angle, as shown in Fig. 4. The center of the earth is fixed at the Oe point on the ecliptic plane. The rotation of the earth around its axis produces sunrise and sunset. At the same time, the earth's axis rotates around the axis perpendicular to the ecliptic to produce the four seasons of spring, summer, autumn and winter.

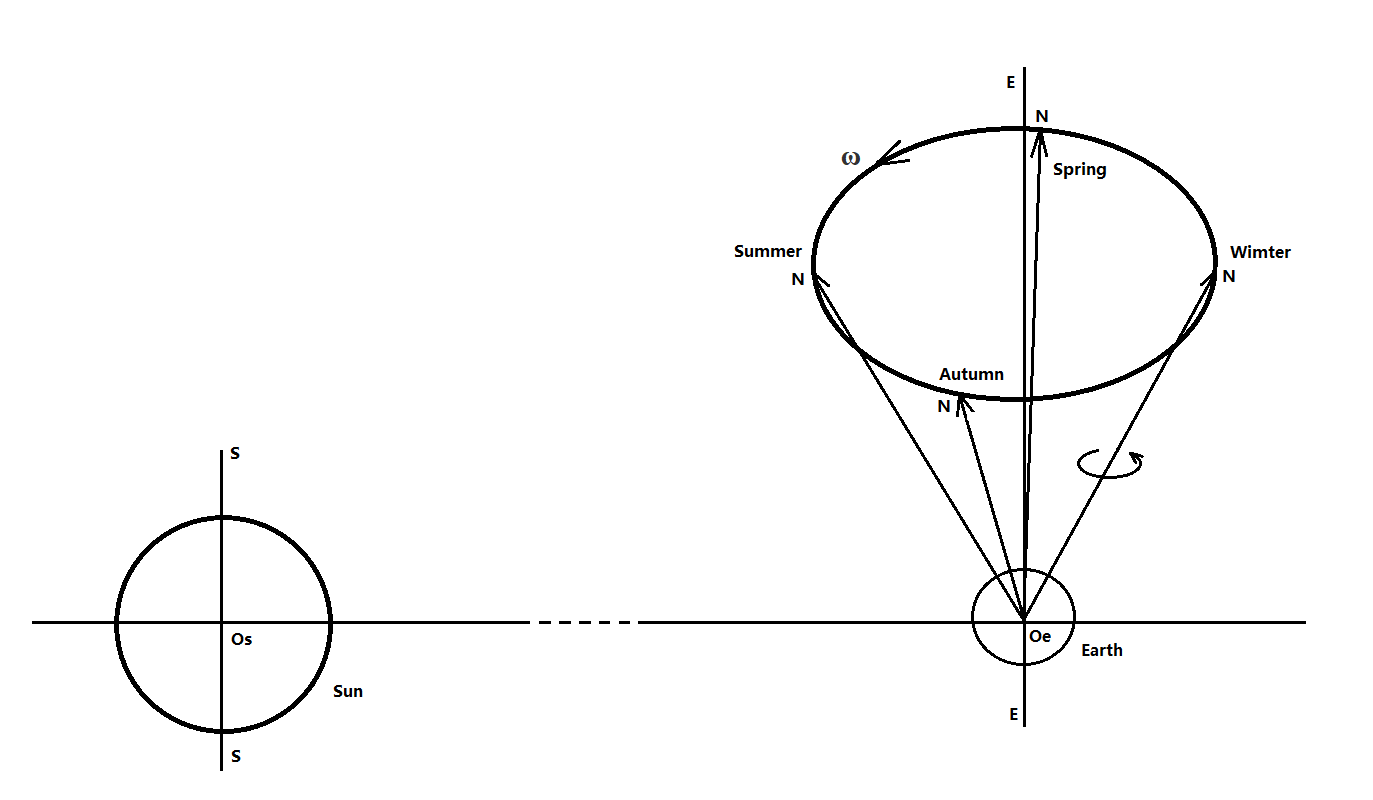


Figure 4 The earth is fixed on the side of the sun, and the center of the earth is fixed at point Oe. While the earth rotates, its axis rotates around the axis EE which is perpendicular to the ecliptic plane.

If we observe the sky on the Tropic of Cancer, our position on the earth at midnight in mid-spring, midsummer, mid-autumn, and mid-winter are shown in Fig. 4(a), Fig. 4(b), Fig. 4(c), and Fig. 4(d), respectively. The Tropic of Cancer is in the same solid angle where the sky can be observed at midnight in the four seasons, rotating along ellipse A1, A2, A3, and A4, as shown in Fig. 6.

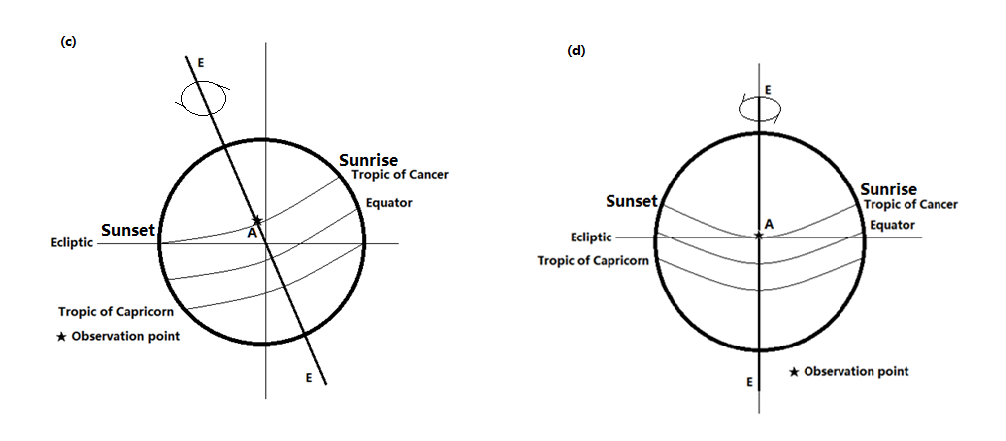
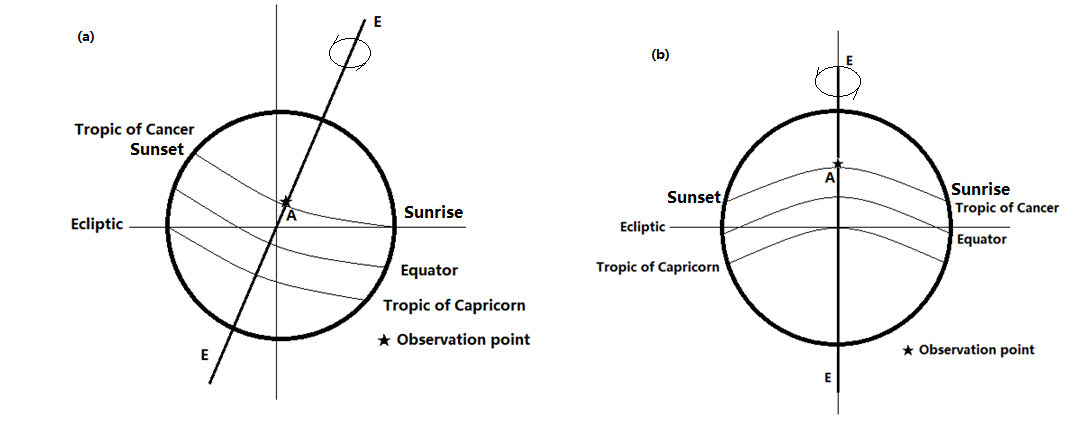


Figure 5 The position of the Tropic of cancer on the earth at midnight in mid-spring (a), mid-summer(b), mid-autumn (c), and mid-winter (d).

Although the position of the earth's Tropic of Cancer at midnight varies with the seasons, they are always within the same solid angle. So there are always some stars, such as the Big Dipper, that can be observed all year round. And because the north-pole of the earth is rotating, the stars we see are as if rotating as well. Therefore, the Big Dipper can be seen all the year, and the direction and the orientation of the Big Dipper are different in different seasons.

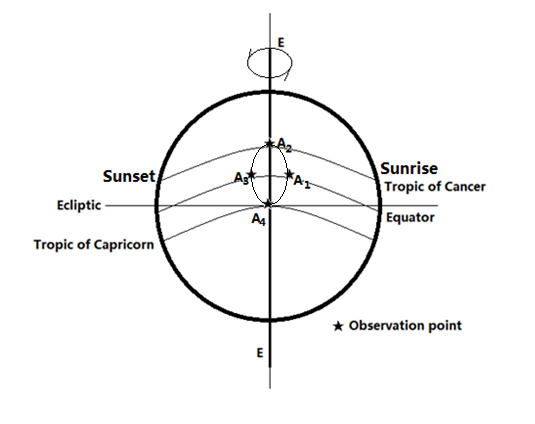


Figure 6 The position of the Tropic of cancer at midnight rotates along ellipse A1, A2, A3, and A4, in the four seasons.

In summary, both the sun and the earth are all stationary. Except the moon, which revolves around the earth, all the other planets revolve around the sun. The earth is fixed on the side of the sun. The sky that can be observed on the earth is only within a solid angle of 0.005 degrees away from the sun. The range of the sky that can be observed on the earth is only a very small area compared with the vast universe. The rotation of the earth around its axis produces sunrise and sunset. At the same time, the earth's axis rotates around the axis perpendicular to the ecliptic to produce the four seasons of spring, summer, autumn and winter. Therefore, some stars, including the Big Dipper, can be observed in all seasons on the earth, but their directions and orientations are different.

**References**

(1) Isaaco Newton, Philosophiae Naturalis Principia Mathematica (1822), ISBN 9780548952610, Kessinger Publishing, LLC, 2008.

(2) Nuofu Chen, The third relative motion between the earth and the sun, figshare (2021): https://doi.org/10.6084/m9.figshare.17169314.v2

(3) Chen, Nuofu, Which of the three forms of relative motion between the earth and the sun is the real motion, figshare (2021): https://doi.org/10.6084/m9.figshare.17258147.v1

(4) Nuofu Chen, Why does the Big Dipper rotate with the seasons, zenodo (2022): https://doi.org/10.5281/zenodo.6476660