

英语科普对照注释读物

The Universe and the Earth

宇宙与地球

〔美〕欧内斯特·施奈德 著

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Part I

Where Are We?

Where are we? Who are we? Have you ever asked yourself these kinds of questions? At one time or another every thinking person has speculated about his place in the cosmos and his identity with the world of man.

Philosophers, scientists, poets, theologians, assorted crackpots, and ordinary people such as you and I have wrestled with these puzzlers over the centuries and still the answers pretty much elude us. What is the universe? How did it come into existence? What power was capable of this gigantic creation? What was the origin of this power? We simply do not, unfortunately, have information on which to base inferences that might lead to some understanding of what lies behind these mysteries.^①

The small amount of concrete knowledge that has accumulated over the years has to do only with the physical nature of the universe — insofar as we can detect and comprehend it.^② The other more nebulous considerations must, for this time, be left to the philosophers and theologians.

Grammatical Notes

① We simply do not . . . these mysteries: 句中 on which to

base inferences 是动词不定式的一种特殊形式，在句中作定语，修饰名词 information。介词 on 是动词 base 所要求的。句中的 that 为关系代词，引出定语从句，修饰 inferences。what 为连接代词，引出宾语从句，作介词 of 的宾语。

- ② The small amount of ... comprehend it: 句中 that 为关系代词，引出定语从句，修饰 knowledge。insofar as... 意为“在……的限度内”或“在……的范围内”。

Translation

第一部分 我们在什么地方？

我们在什么地方？我们是什么？你问过自己这类问题吗？每个善于思考的人都在某时思索过他在宇宙中的位置和他与人类社会的一致性。

哲学家、科学家、诗人、神学家、各种古怪的人，以及象你、我这样的普通人，多少世纪来都为这些难题伤脑筋，各种答案仍然令人颇难理解。宇宙是什么？它是怎样产生的？什么力量能进行这样巨大的创造？这种力量的起源是什么？可惜，我们根本没有对这些奥秘作出某种解释的知识。

在我们能够探索和理解的范围内，多年积累下来的一点点具体知识，仅涉及宇宙的物理性质方面。另一些情况不明、有待思考的问题，暂且留待哲学家和神学家去解决。

1. A Small Chip in Angry Sea

Generally speaking, the universe is hostile to man. Almost everything that comes naturally to us from space is capable of harming us and if it were not for some unique properties of the earth, we could not exist here at all.①

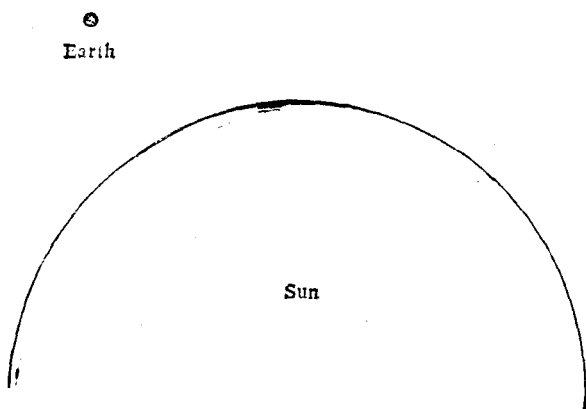


FIGURE 5. *Comparative sizes of Sun and Earth.*

The very insignificance of this planet in the vastness of the known universe is enough to numb the minds of most. Long ago Sir James Jeans said that there are more stars in the universe than there are grains of sand on all the beaches of all the world's oceans, and if stars (among which our sun is quite ordinary) were the size of sand grains, we would need an exceptionally good microscope to find something as small

as the earth.② The particle of sand representing the sun would be one million times larger (in volume) than the speck of dust standing in for the earth. In terms of comparative diameters, the two would look something like the Figure 1 diagram.

It may be appropriate at this point to remind you that there presently are 3,500,000,000 living humans crowded onto the surface of that dot — with nowhere else to go!

Grammatical Notes

- ① Almost everything . . . at all: 关系代词 that 引导的定语从句修饰 everything。if it were not for some unique properties of the earth, we could not exist here at all 中的谓语形式是表示与现在事实相反的假设情况的虚拟语气。
- ② Long ago Sir James Jeans . . . the earth: 句中 that 引导的宾语从句中的谓语用一般现在时表示永恒的真理。动词不定式 to find something as small as the earth 为目的状语。

Translation

1. 怒海中的碎屑

一般说来，宇宙对人类是不友好的。从太空自然而来的几乎一切东西都会伤害我们。假如地球没有某些独特的性质，我们根本不能存在。

在广阔无垠的已知宇宙中，地球这颗行星是微不足道的，

大多数人对此无法想象。很久以前，詹姆斯·吉恩斯爵士说，宇宙中的恒星比全世界各海洋的沙滩上的沙粒还要多。如果这些恒星（太阳只是其中相当普通的一颗恒星）有沙粒那么大，那我们就需要一台特别好的显微镜才能发现象地球这样小的东西。代表太阳的沙粒（在体积上）要比代表地球的微尘大一百万倍。按照相对直径而言，两者看上去有点象图一所示的情况。

这里应该提醒你一下，目前在这个小圆点的表面上，挤着3,500,000,000人——没有别的地方可去！

2. Earth Dimensions

Even though it is small and insignificant relative to other astronomical bodies, the earth is quite large when viewed up close — for example, by you or me standing on its surface. It is so large, in fact, that we ordinarily have little indication that it actually is almost spherical. From where I sit, to be sure, it looks quite flat! (Have you ever tried to convince anyone that the earth is round? How would you go about it without having to appeal to an authority?)

Some of the early Greeks not only believed in the rotundity of the earth but one of them actually measured its circumference and came surprisingly close to the approximately 25,000 miles we now know it to be.*^① How far is 25,000 miles? A 600 miles per hour jet could fly around the earth in a little more than 40 nonstop hours. A man on a bicycle averaging 10 mph, 12 hours per day would make the trip in about 7 months — if he could find a smooth, circumferential road. And if you walked briskly at 3 mph, it would take you almost two years to circle the globe. By way of contrast, astronauts in orbit go once around in 90 minutes!

*Eratosthenes (third century B.C.) measured the earth's circumference (Figure 2) by observing that on the day when the sun was directly overhead at Syene, its altitude at Alexandria was about 7° south of the zenith (the point directly overhead). Knowing the distance between the two cities and assuming that the earth was a sphere, he concluded that the circumference was $360^\circ/7^\circ \times 490$ miles — the distance between the two cities.

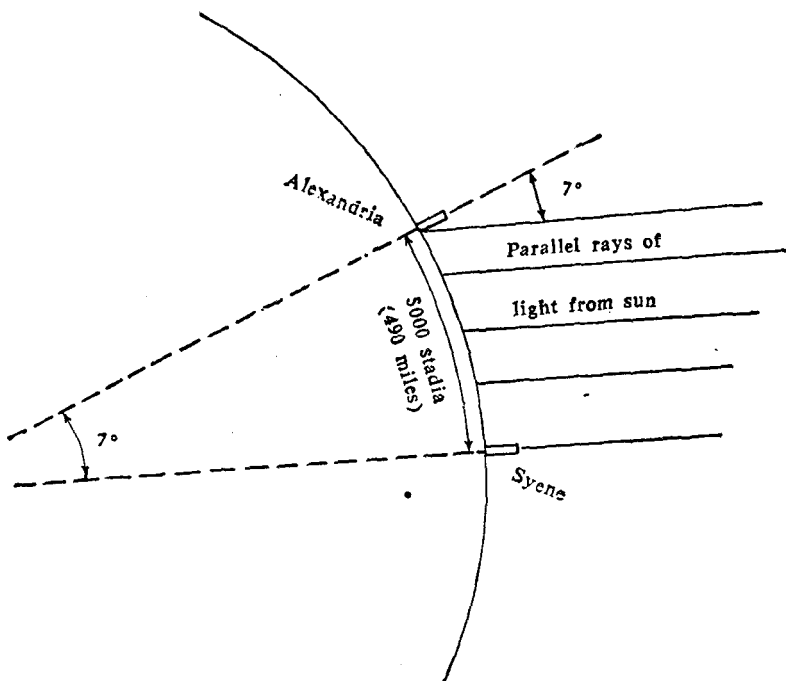


FIGURE 2 *Eratosthenes' method for determining the circumference of the earth.*

Have you watched an eclipse of the moon and noticed the curved edge of the earth's shadow as it moved across the lunar surface, or seen photos of the earth taken from satellites and by the astronauts on their moon trips?^② Are these reasonable proof that the earth is spherical? We can see that the moon and sun and other planets seem to be spherical in shape; should the earth be different? Why are astronomical bodies spherical? Why should they not be cubes or pyramids?

Grammatical Notes

- ① Some of the early Greeks... it to be: 句中 not only... but... 连接两个并列谓语 believed in 和 measured... and came。we now know it to be 是省略了关系代词 that 的定语从句, 动词不定式 to be 是宾语补足语。
- ② Have you watched... on their moon trips: 句中 as 引导的是时间状语从句。过去分词短语 taken from satellites and by the astronauts on their moon trips 是 photos 的定语。

Translation

2. 地球的大小

地球与其他的天体尽管相对地说是很小、很微不足道的, 但比如说, 你或我站在地球表面就近观察地球的话, 那它还是相当大的。事实上地球很大, 我们通常无法证明它实际上近乎球形。确实, 从我坐的地方来看, 它相当平坦! (你有没有想让别人相信, 地球是圆的呢? 如不请教学术权威, 那你怎么办呢?)

有些古希腊人不仅相信地球是圆的, 他们当中还有个人实际上测算过地球的圆周长度, 得到的结果与我们如今已知的长度约25,000英里出人意料的接近*。25,000英里有多远呢? 一架每小时飞行600英里的喷气式飞机作不着陆飞行, 绕地球一周约需40余小时。如果有人找到一条光滑的环形公路, 每天以平均每小时10英里的速度骑自行车跑12小时, 大约需要7个月

才能跑完全程。如果你以每小时 3 英里的速度轻快地步行，绕地球一周需要两年左右。作为对照，宇航员在轨道上飞行，90 分钟可绕地球一周。

你观察过月食的情况吗？你注意到地球的阴影移过月球表面时显示出的月牙形的边缘吗？你看见过从卫星上拍摄的照片和飞往月球的宇航员拍摄的照片吗？这些不都是地球呈球形的适当证明吗？我们可以看出，月亮、太阳和别的行星似乎都是球形的，难道地球就不同吗？为什么天体是球形的？为什么不是立方体或角锥体呢？

• 埃拉托斯特尼（公元前三世纪）在白天太阳位于赛尼城观测点头顶上时进行观察，以测定地球圆周的长度。与此同时，在亚历山大里亚城进行观察，则太阳位于天顶^①（指观测点头顶上的那一点）偏南 7° 左右。已知两座城市之间的距离，假设大地是一个球体，他推算出地球的圆周为 $360^{\circ}/7^{\circ} \times 490$ 英里（两座城市之间的距离）。（见图二）

3. Earth Motions

Since we are not directly aware of the movements of the earth, we must rely upon secondary and indirect evidence to convince ourselves that it actually does move.① More than

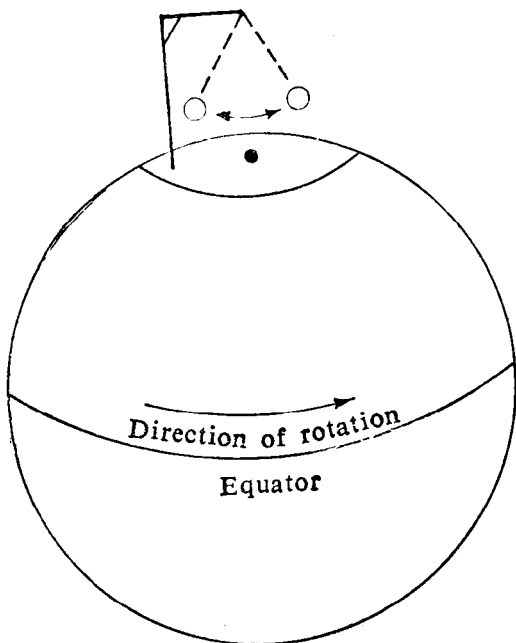


FIGURE 3 *As the pendulum bob swings back and forth in the same direction over the north pole, the earth makes a complete turn under it in 24 hours.*

a century ago, Jean Foucault proved that the earth rotates. He suspended a heavy ball by a long wire attached high in the dome of a building. Foucault pendulums now are rather common in museums and other public buildings. As you watch the heavy bob swing back and forth, it appears to slowly change direction. Since there is no external force affecting the pendulum, the only explanation is that the earth is turning under the freely oscillating weight! (Figure 3)

There are certain natural events occurring on the earth which indicate that the world turns. Can you name some of them? Astronomers tell us the earth is moving in about a dozen different ways simultaneously: rotating daily, revolving annually, wobbling like a tired top, being moved slightly by the moon, traveling through space with the sun, etc.

The planet earth revolves around the sun once each 365.25 days. (The odd $1/4$ makes necessary an extra day in February every fourth year.) Now can you prove that the earth revolves? Are the seasons also proof of the earth's revolutions? You are probably inclined to say yes, however, would not the seasons be identical with what they are now if the sun revolved around the earth? I am afraid that we will have to look further for our proof.

Proof that the earth revolves came some 125 years before Foucault devised his pendulum. The English royal astronomer of the time (James Bradley) discovered something called the aberration of starlight. This is a slight displacement of telescopic stellar images due to the speed (about 18 miles per second) of the earth through space as it revolves around the sun. The discovery of stellar parallax furnished further proof of the earth's revolution.* Neither of these phenome-

na could in any way be attributed to the movement of the sun around a stationary earth.②

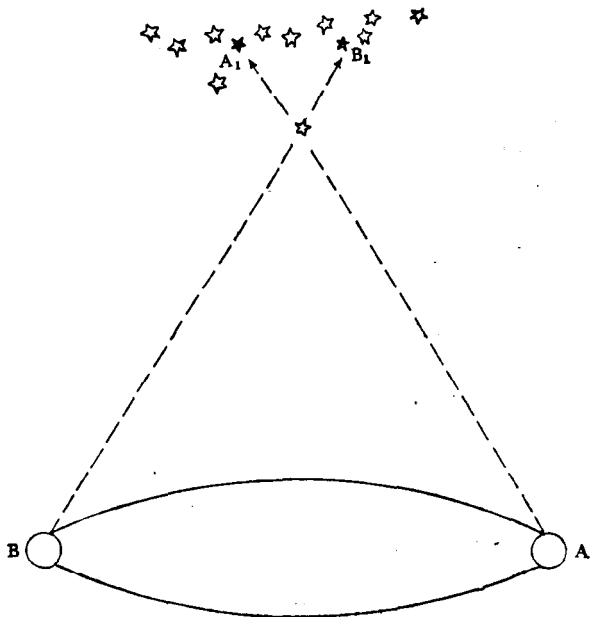


FIGURE 4 *Stellar parallax.*

Grammatical Notes

- ① Since we are not directly aware of ... does move: 句中 since 引导的是原因状语从句, 说明主句中的谓语 must

*Stellar parallax (Figure 4) is the apparent motion of nearer stars against the background of more distant stars. This phenomenon is due to the movement of the earth along its annual orbit which has an average diameter of about 186,000,000 miles.

rely upon. 动词不定式短语 to convince ourselves that ... 在句中作定语，修饰名词 evidence。

- ② Neither of ... a stationary earth: 句中 neither 是一个代词，意思是“这两种现象都不...”。be attributed to 意为“归结于...”。

Translation

3. 地球在运动

我们不能直接感知地球在运动，所以要依靠次要的和间接的证明，使我们相信地球确实在运动。一百多年以前，吉恩·傅科证明地球在转动。他在建筑物穹顶上用一根长钢丝悬挂一个重球。目前，在博物馆和其他公共建筑物中傅科摆^②是相当普遍的。当你看到悬挂着的重球在来回摆动时，它在慢慢地改变方向。既然没有外力在影响它，那就只能有一种解释：在自由摆动的重物之下地球在转动！（见图三）

在地球上有些自然现象表明地球在转动。你能说出一些现象吗？天文学家告诉我们，地球同时以十来种不同方式在运动：每日的自转^③，每年的公转^④，象转久了的陀螺那样摇晃，受月球影响而微动，和太阳一起在太空运动等。

地球这个行星每365.25天绕太阳一周。（零数1/4天使我们每四年要在二月加上一天。）现在你能证明地球公转吗？季节也证明地球公转吗？你大概会说“是的”。然而，假设太阳绕着地球转，季节不是也和现在一样吗？恐怕我们还得进一步加以论证。

在傅科发明傅科摆之前约125年，就已经证明地球公转。当时的英国皇家天文学家（詹姆斯·布拉德利）发现了一种叫

做（星光的）光行差^⑤的现象。地球在公转时越过太空的速度（约每秒18英里）使望远镜中恒星的映象在位置上略有移动。恒星视差^⑥的发现进一步证明地球公转。这两种现象无论如何都不能归之于太阳绕着不动的地球转。

• 恒星视差就是较近的恒星以较远的恒星为背景的显而易见的运动。这种现象是由于地球在公转轨道上运行而产生的。轨道的平均直径约186,000,000英里。（见图四）