Raintree Fusion
雨树溶溶

英国最具影响力的青少年科普读物之一

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VOYAGE OF A LIGHT BEAM

光波旅行记

【光】

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Contents 目录

有些单词被印刷成粗体，**就像这样**。你可以在第30页中找到它们的意思，还可以在单词第一次出现时，在相关书页下方的方框内发现它们的含义。

A high-speed trip
一次极速旅行

You are going on the trip of a lifetime! It's a trip across part of our **galaxy**. You will see many **stars**. You will also see Earth.

Have you ever thought about the stars you can see in the night sky? Each one is a huge ball of gas like our Sun. They look so tiny in the sky because they are very far away.

We are going to take a trip from one of those stars to Earth. The trip would take thousands of years in a spacecraft. We need something a bit quicker. We are going to follow a beam of light.

Light is a kind of **energy**. Light is like all energy. It can make things change. Light allows us to see things. We'll find out how on our trip.

你就要开始一次时空旅行了！这是一次穿越**星系**之旅。你会亲眼看见许多**星球**，当然也有地球。

你想过夜空中的星星原本是什么样子的吗？每一颗星星都像太阳一样是个巨大的气态球体。因为它们离我们极其遥远，所以抬头望去，感觉它们那么渺小。

我们就要从其中的一个星球开始到地球的旅行了。如果乘坐一架宇宙飞船，这次旅行将历时数千年。我们需要让速度更快一些，所以就让我们跟随光束前行吧。

光是一种**能量**。光和所有的能量一样，能让事情改变。光可以让我们看到物体。通过这次旅行我们就能知道这是怎么一回事了。

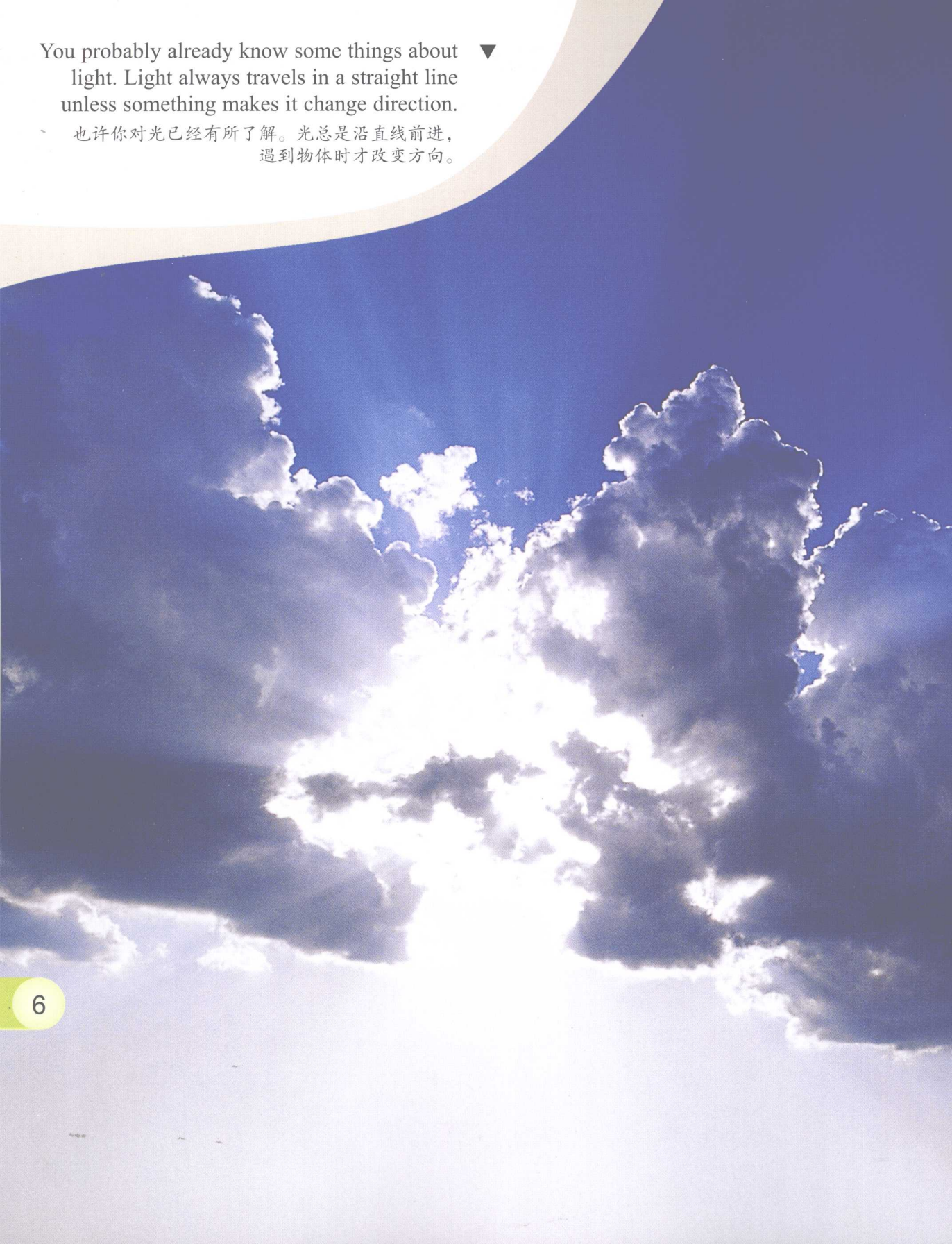
energy (能量)　galaxy (星系)　star (星球)

▼ This is the Apollo 10. It is one of the fastest spacecraft. Even in this spacecraft our trip would take thousands of years. Light can travel a lot faster.

这是阿波罗10号，最快的宇宙飞船之一。即使乘坐这艘飞船进行太空旅行，我们也要历时数千年。而光穿行的速度要快得多。

You probably already know some things about light. Light always travels in a straight line unless something makes it change direction. ▼

也许你对光已经有所了解。光总是沿直线前进，遇到物体时才改变方向。



The fastest thing there is
速度最快的物质

Why follow a beam of light? Because it is the fastest thing there is. When we switch on a lamp the light is just there. It is all over the room, all at once. But light does not really reach everywhere all at once. It travels at a speed of about 300000 kilometres (186000 miles) each second!

At the speed of light you could get to the Moon in just over a second. You could reach the Sun in about 8 minutes. So fasten your seat belt!

为什么要跟随光束前行呢？因为光速是宇宙间最快的速度。一打开灯，就看见光了。霎那间，整个房间亮起来了。但是，光并不是同时到达房间各个角落的。它传播的速度大约是每秒30万公里（18.6万英里）！

以光速旅行，只需1秒多的时间就能到达月球，大约8分钟的时间就能到达太阳。所以，要系好安全带！

Light fantastic
神奇的光

- light is a kind of **energy**
- most of the light we get on Earth is from the Sun
- some other light sources include light bulbs, candles, fires, or other **stars**
- light beams travel in straight lines

- 光是一种**能量**
- 地球上可获得的光大多数来自太阳
- 其他的光源包括灯泡、蜡烛、火或其他的**星球**
- 光束沿直线传播

A star in the Swan

天鹅座的一颗星

Our light beam is starting from a **star** called Deneb. From Earth, Deneb looks like a tiny point of light. In fact, it is 60 times bigger than the Sun. It shines 60000 times more brightly. But it is more than 100000000 times further away!

Deneb looks so small because it is so far away. It is 15200000000000000 kilometres (9400000000000000 miles) from Earth. This makes it one of the furthest stars we can see. A light beam is the fastest thing there is. But it still takes many years to travel from Deneb to Earth. So we had better get going!

我们的光束是从一个叫做天津四的**星球**发出的。从地球上看，天津四就像一个微小的亮点。事实上，它比太阳大60倍，它闪耀的光比太阳明亮6万倍。可是，它比太阳远1亿多倍！

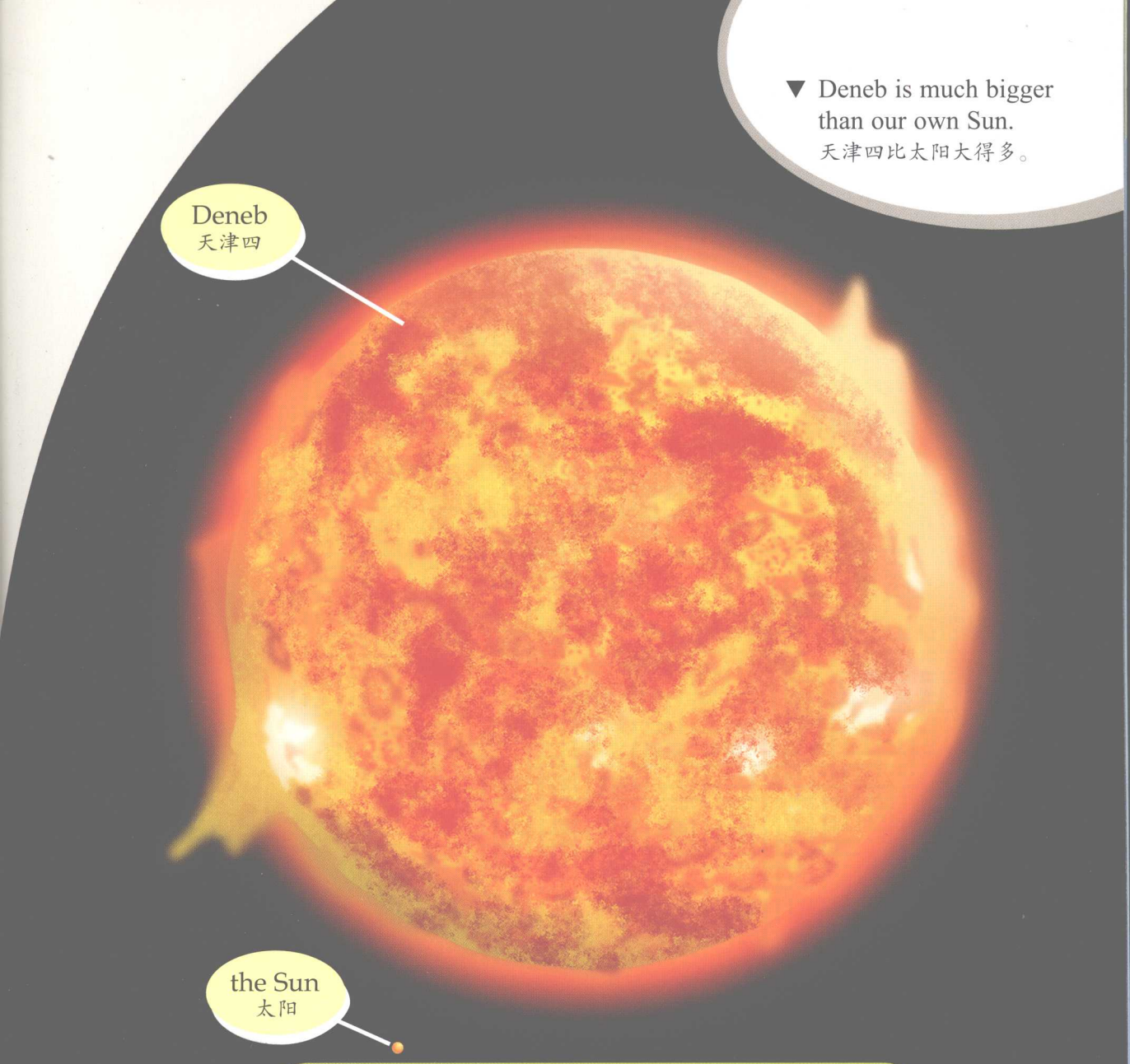
天津四看起来如此微小是因为它太遥远了。它距离地球15200000000000000公里(9400000000000000英里)。所以它是我们能看到的最远星球之一。光束是宇宙间最快的速度，但是光束从天津四传播到地球仍需要许多年的时间。所以我们最好马上动身吧！

▼ Deneb is part of a **constellation** called Cygnus, or the "Swan". A constellation is a pattern made by stars in the sky.

天津四是天鹅座**星群**中的一部分。星群就是指天空中许多星星聚在一起呈现的形状。

constellation (星群)　light year (光年)

▼ Deneb is much bigger than our own Sun.
天津四比太阳大得多。



Light years
光年

Kilometres or miles are too small for measuring the distances in space. Instead scientists use a measurement called a **light year**. This is the distance that light can travel in 1 year. A light year is roughly 9500 billion kilometres (5900 billion miles).

用公里或英里作为单位来测量太空中的距离实在是太小了。科学家使用一种叫做**光年**的测量单位。光年是光在1年时间内传播的距离。1光年大约等于9万5千亿公里（5万9千亿英里）。

Light beam from Deneb

天津四发出的光束

The **star** Deneb is a huge ball of gas. It is hotter than any fire on Earth. A star creates huge amounts of **energy**. A lot of this energy is heat and light.

Deneb is always giving out light. The light shines out in all directions. We are going to follow a light beam all the way to Earth. It must be going in exactly the right direction. This is important because you can't steer a light beam. It only goes straight ahead!

OK, so we know the direction to Earth. Now we pick a light beam, and off we go!

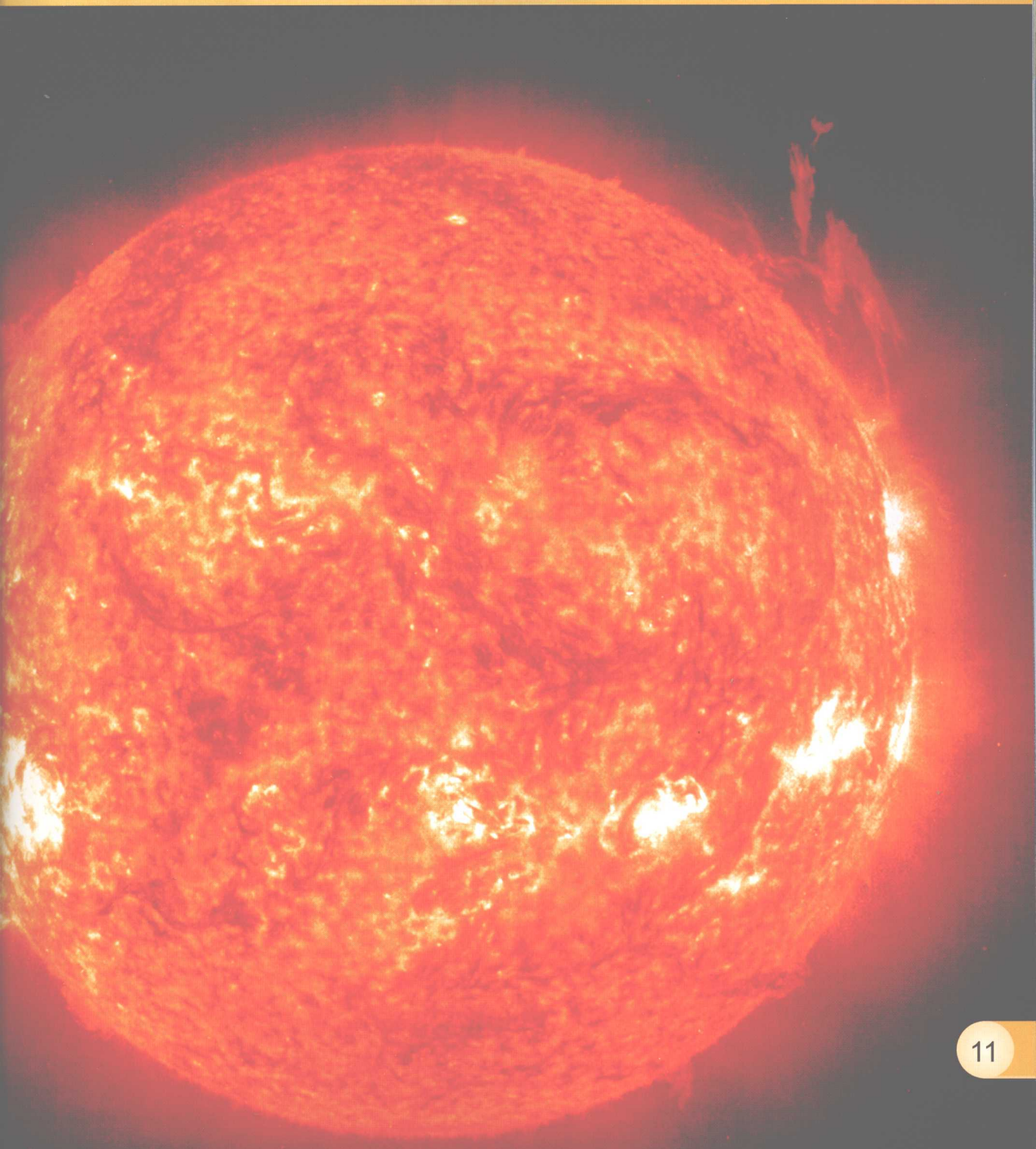
天津四这个**星球**是一个巨大的气态球体，它比地球上的任何火源都炽热，能产生巨大的**能量**。这些能量主要是热和光。

天津四一直在发光。光向四周闪耀。我们就要跟随其中的一条光束一路直达地球。这束光必须要沿着正确的方向行进，这一点至关重要，因为光束只能直行，我们无法驾驭光束！

好了，我们确定地球的方向了。现在，选择一束光，出发！

This photo shows that the Sun is a swirling ball of gas, just like Deneb. It creates light energy, too. ▶

这张照片显示太阳与天津四一样，也是一个涡流气态球体，也能生成光能。



Where are we going?

我们去哪？

Earth is part of a **galaxy** called the Milky Way. The galaxy is very large. We are travelling 1600 light years from Deneb to Earth. But we will cross only a small part of this galaxy.

The Milky Way has a bright centre called the hub. The hub is packed with billions of **stars**. Spiral arms spread out from the hub. Our Sun is near one of these arms. It is called the Orion arm. Deneb is near the Orion arm, too.

At the start of the journey we travel through empty space. There is nothing to see. Then a big ball of rock appears ahead. It's a planet. It looks like we are heading straight for it!

地球是银河系**星系**的一部分。银河系广阔无限。我们要走上1600光年才能从天津四到达地球。但即使这样，我们也只是穿越了这个星系的一小部分。

银河系有一个明亮的中心叫做星系核心，它周围有数十亿颗**星球**。螺旋的臂状星体群从星系核心伸出。太阳就位于其中一个叫做猎户座的臂状星体群附近。天津四也在猎户座附近。

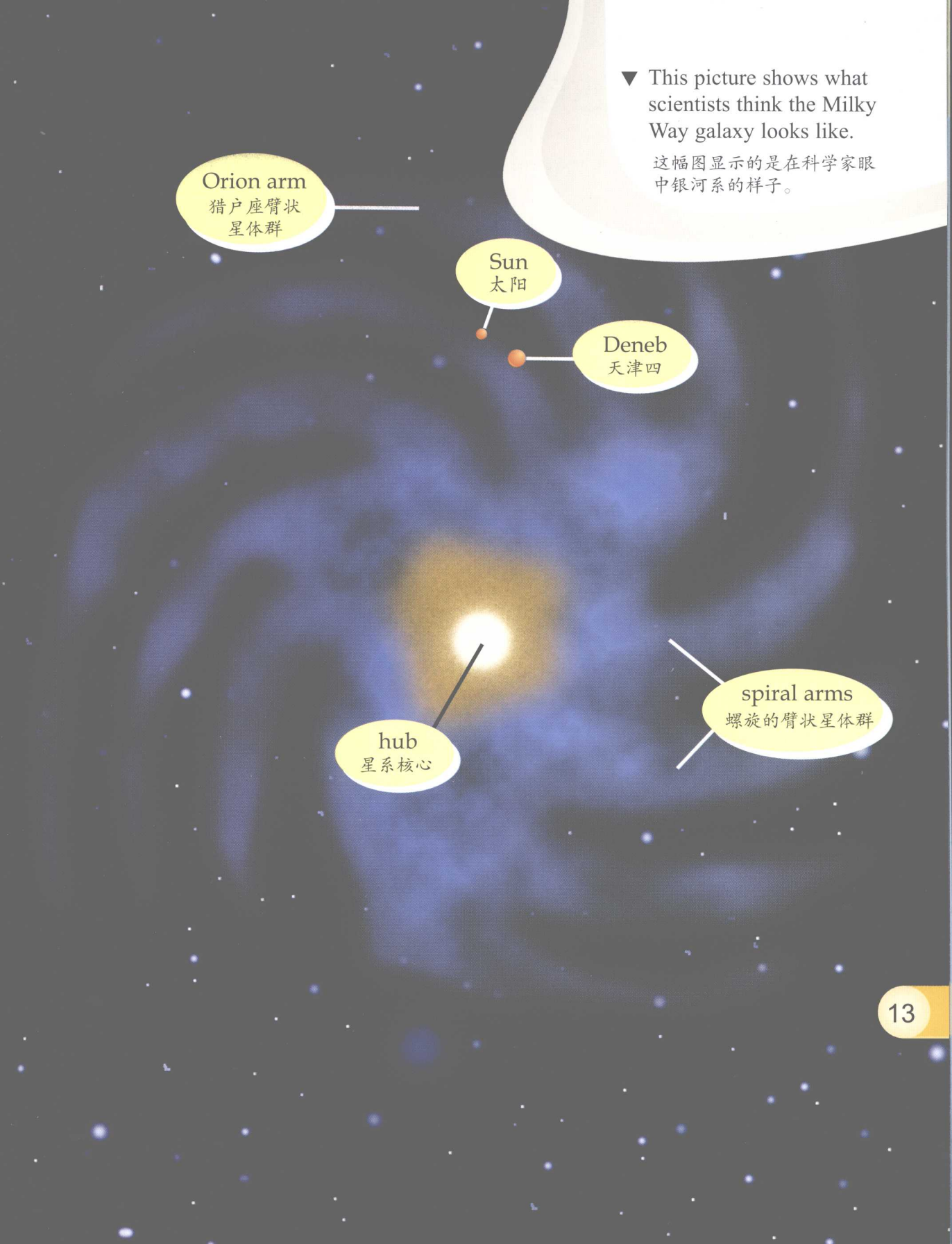
旅行之初，我们穿越空寂的太空，什么也看不见。突然前方出现一个巨大的岩石球，这是一颗行星。看起来我们直奔它而去！

Speedy Scientist

光速科学家

Albert Einstein was a famous scientist. He lived from 1879 to 1955. He started thinking about the speed of light when he was just 16 years old. Later he worked out that nothing could travel faster than the speed of light.

艾尔伯特·爱因斯坦是一位著名的科学家。他生于1879年，死于1955年。他从16岁开始思考光速的问题。后来他推算出光传播的速度是最快的。



▼ This picture shows what scientists think the Milky Way galaxy looks like.

这幅图显示的是在科学家眼中银河系的样子。

Planets and nebulas
行星与云翳

Most of the time, light can travel through space without any problem. Much of space is **transparent**. There is nothing to stop light getting through. A planet is different. It is **opaque**. This means it does not let light through.

We won't make it to Earth if our light beam hits this planet! You can't steer a light beam. We can only wait and see what happens. Luckily our light beam misses the planet and shoots straight on.

Many other light beams from Deneb head straight into the planet. Some of them are taken in by the rocks. They are **absorbed**. Others are **reflected**. They bounce off in all directions.

多数时候光可以穿越太空,不出任何问题。大部分太空是**透明**的。没有物质阻止光线穿过。行星却不一样，它是**不透明**的，这意味着它不能让光通过。

如果我们的光束撞击到这颗行星，我们就无法到达地球了！你根本无法驾驭光束。那我们就只能等着看会发生什么了。幸运的是，我们的光束与它擦肩而过，倏地继续直行。

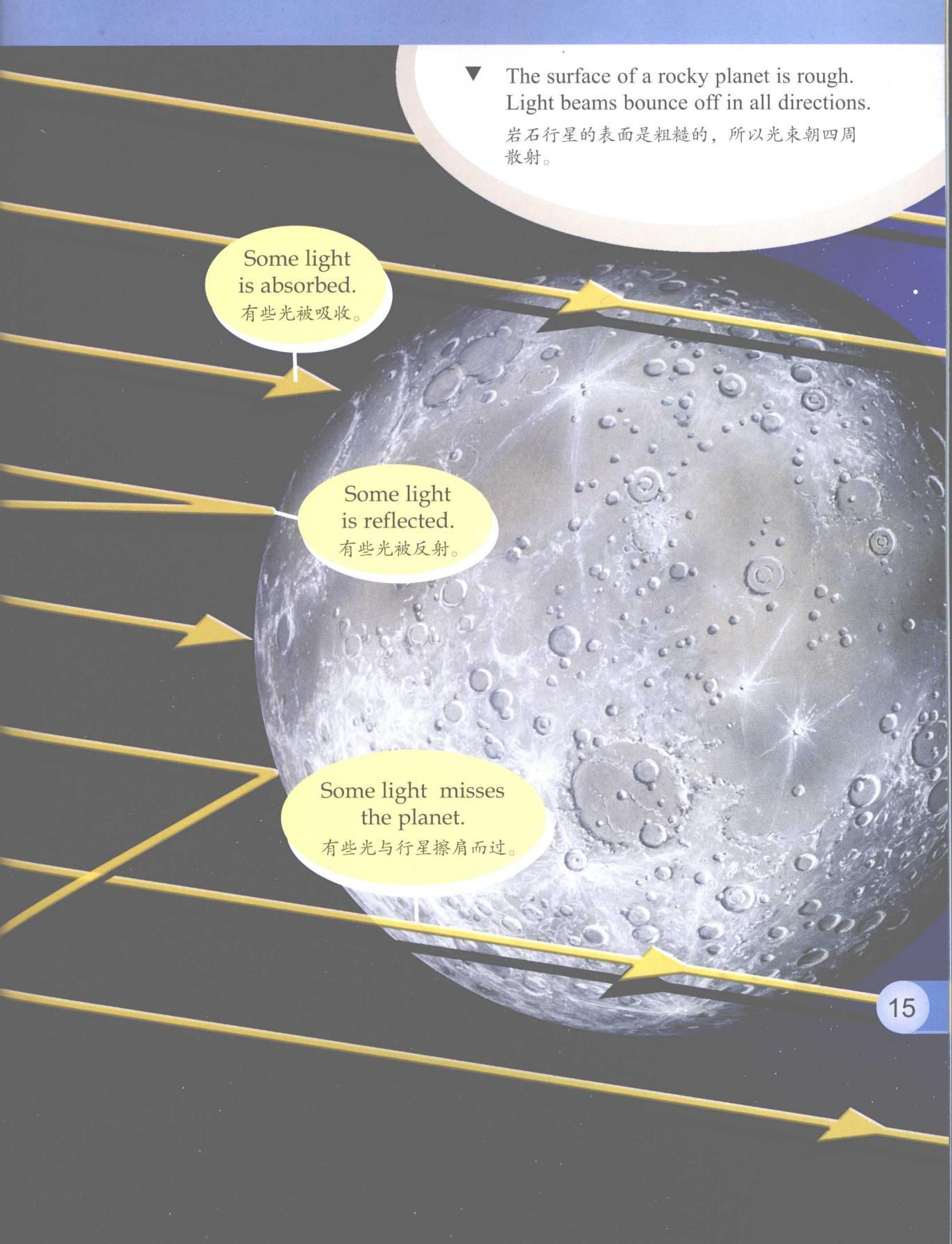
从天津四发出的许多其他光束直接撞到这颗行星。有一些光束因为被岩石捕捉，被**吸收**了。还有一些光束被**反射**出去，朝四周散射。

Warming light
温暖的光

Remember that light is a kind of energy? The light beams that are absorbed by the rocks don't just disappear. They make something happen. The light energy warms up the rocks.

还记得光是一种**能量**吗？被岩石吸收的那些光束并没有凭空消失。它们能使事物发生变化。光能使这些岩石变热。

transparent (透明的)　opaque (不透明的)　absorb (吸收)　reflect (反射)


▼ The surface of a rocky planet is rough. Light beams bounce off in all directions.
岩石行星的表面是粗糙的，所以光束朝四周散射。
Some light is absorbed.
有些光被吸收。
Some light is reflected.
有些光被反射。
Some light misses the planet.
有些光与行星擦肩而过。

Shining gas clouds
闪耀的气态云

We are out into deep space now. There is nothing for millions of kilometres. Far in the distance there is a fuzzy-looking light. As we get closer we see that it is an enormous cloud of gas and dust. It is a nebula. Parts of the **nebula** are glowing brightly.

This time, our light beam does not miss. It goes straight into the nebula. Will it get through? Some light beams are taken in. They are **absorbed** by the gas and dust in the nebula. The light **energy** makes the gas glow. Luckily, our light beam gets through. It has not changed.

我们现在开始进入深层太空。方圆数百万公里一无所有。极远处看起来有模糊的光亮。再走近一些我们看到它是一个由气体和尘埃组成的极其巨大的云团。这就是**云翳**。云翳的某些部分闪闪发光。

这一次，我们的光束没能避开云翳，而是直接钻入云翳之中。我们能穿过去吗？有些光束被捕捉，被云翳中的气体和尘埃所**吸收**。这些光的能量使气体发光。幸运的是，我们这道**光束**顺利通过了，没有发生改变。

Nebulas
云翳

Nebulas are huge clouds of gas and dust. Different things can make a nebula. Some nebulas are left over from giant stars that have exploded. Others are "star nurseries", where new stars are being made.

云翳是由气体和尘埃组成的巨大云团。各种东西都能形成一个云翳。有些云翳是一些巨大星球爆炸的残留物，还有一些是孕育新星球的"星体滋生地"。

nebula (云翳)