

## What is Meteor? 什么是流星?

Meteors appear as fast-moving streaks of light in the night sky that usually will only last about a second or two. They are commonly referred to as "falling stars" or "shooting stars". Sometimes meteor may even leave a trail behind.

The vast outer space is actually not empty as it seems to be; there are a lot of dust particles, tiny grains of sand and ice floating around in space. When these particles or **meteoroids** come too close to Earth, Earth's gravity will pull them into the atmosphere, at a speed of 10 to 70 kilometres per second, to produce streaks of light in the night sky known as meteors.

Meteor is a natural phenomenon that occurs in the Earth's atmosphere.

流星是发生在地球大气周围的自然现象。

晴朗的夜晚，当我们抬头仰望天际时，偶然见到一道亮光划破长空，一闪而逝，快速的飞向远方才消失，这就是流星现象。它们那灿烂的光芒短暂而绮丽，有些还留下途径痕迹，称为流星余迹。

浩瀚的宇宙并非是我们想象这么的空空如也。在地球外围其实浮游着大量的沙石、冰块及尘埃。这些可能形成流星的物质称为**流星体**，体积非常细小。当流星体飞近地球时，会被地球的引力所吸引，以每秒 10 至 70 公里的惊人速度“闯入”大气层。

When meteoroid zooms through the atmosphere with such a high velocity, the friction with Earth's atmosphere heats it up and causes it to burn and glow. The result is a fast-moving streak of light in the night sky called a "meteor".

在高速飞驰于大气层的转瞬间，流星体因与空气摩擦，便会令它们燃烧，以致它短暂发光，在晴夜出现一条快速又光亮的痕迹，我们称之为“流星”。

Most meteors will completely burn up in the atmosphere at an altitude of 100 kilometres. However, some bigger chunk of meteoroids may survive the trip through the atmosphere and reach the ground. These remnants are known as **meteorites**.

大部分流星都会在离地面 100 公里的上空消耗殆尽。反之一些较大的流星体，由于物质无法烧尽，其残骸就会坠落到地面上，叫做**陨石**。

## What is Meteor Shower? 什么是流星群或流星雨?

On a normal night we can typically see a few meteors per hour. This type of meteors is called the **sporadic meteors**. However, at certain times of the year the rate of observable meteors is much higher. These periods are called **meteor showers**.

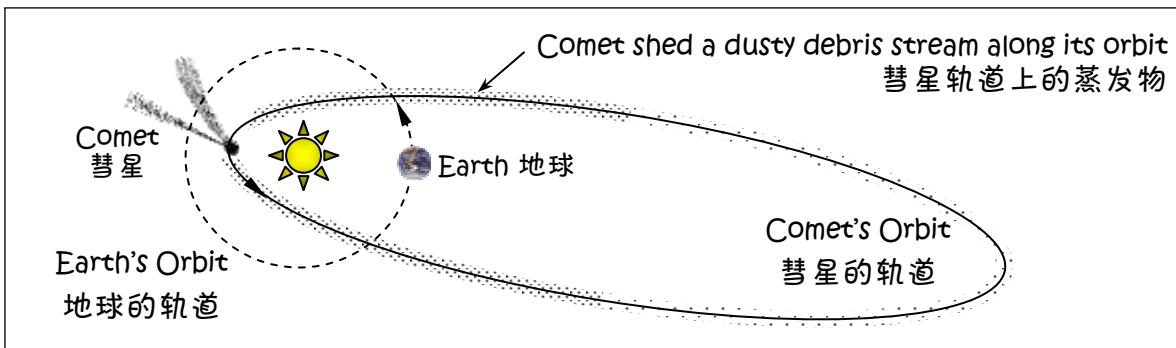
在晴朗的夜晚，我们一般每小时可见的流星只有区区的几颗而已。这类流星我们称为**偶现流星**。但是一年之中有些时候流星的数量会有所增加，这个时候就是**流星群/雨**的出现。

An increase in the number of meteors at a particular time is called a meteor shower.

所谓的**流星群或流星雨**，其实是指在一段特定的时间内，  
有很多流星在天空中出现。

Most meteor showers have their origins with comets. Comets are primarily composed of ice and dust and when they approach the Earth, the Sun's heat will evaporate the ice and they will shed an icy, dusty debris stream which is then distributed along their orbits. When our Earth passes through a comet's orbit, these left-over comet debris will "bombards" Earth and causes the rate of meteors increases.

流星群/雨的成因与母彗星有直接的关系。彗星大多是由凝固成冰的气体及尘埃所组成。每当一颗彗星接近地球时，太阳的热力会促使彗星蒸发而在它绕日轨道上留下大量的零碎冰块及沙石尘埃。当地球穿过这彗星的轨道时，地球的引力便会把散落的尘埃大量地吸引进入地球大气，随即与大气层磨擦，形成流星群/雨。



Due to Earth orbit around the Sun, we will roughly be at the same location in space every year. Hence meteor showers will occur almost the same time each year when Earth crosses the comet's orbit. The difference between the yearly showers is related to how close the comet's orbit to ours and how long ago the debris was ejected.

地球因为公转，每隔一年便会在太空中返回大致相同的位置，因此流星群/雨在每年大约相同的时间也会发生。而每年的差别在于地球与彗星轨道有多接近，还有彗星的尘埃是多久前残留下来的。

## Why is Meteor Shower named after Constellation?

### 为何流星群、流星雨会以星座命名？

During a meteor shower, if we observe carefully, we will find that the path of the meteors seem to radiate from a point in the sky. This point is called the **radiant** of the meteor shower and is just a perspective effect. Actually all the meteors enter the Earth's atmosphere in a parallel path, but from our Earth perspective, the meteors appear to come from the radiant.

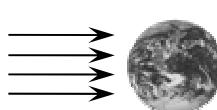
当流星群/雨出现时，若细心观察，便会察觉流星是由天空中某一特定点发射出来；这个点称为流星群/雨的**辐射点**。其实流星群/雨是平行向地球飞来，但由于透视的关系，从地球上看好像是从一个辐射点飞出。

If we trace back the path of the meteors during a meteor shower, we will find that all the meteors seem to originate from a point in the sky. This point is known as the radiant.

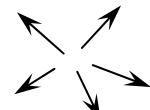
当我们追溯造成流星群/雨的流星划过的方向往回伸延时，将发现流星的路线会交叉在一个点上。这个点我们称之为**辐射点**。

Meteor shower is named based on the location of their radiant. For example, if the radiant is located in constellation Perseus, the particular meteor shower is known as the Perseids. If there is more than one meteor shower in a constellation, then the shower is named after the bright star nearest to the radiant. For example, the Eta Aquarids and Delta Aquarids meteor shower are both from the constellation Aquarius.

流星群/雨的命名亦以流星群/雨的辐射点来决定。辐射点位于哪一个星座，流星群/雨就以那个星座命名；例如辐射点在英仙座的流星群便叫做英仙座流星群。如果同一星座内有两个流星群/雨，就用辐射点附近亮星的名称来命名；例如宝瓶座  $\eta$  及  $\delta$  流星群。



Meteor Stream moves  
in parallel path  
流星体是平行  
向地球飞来



Apparent Radiant  
in the sky  
流星好象从一个  
辐射点飞出

The radiant is an optical illusion - the meteors are moving along parallel paths, but appear to come from a single point, just as a stretch of parallel railroad tracks will appear to meet at a point.

辐射点其实只是一个错觉。平行飞向地球的流星从地球上看似由一个点发出，这和平行的火车轨道在远方会聚是同样的道理。

Meteors may seem to originate from its radiant, but by the time we see it, it may already leave the radiant and can appear anywhere in the sky. It is just that if we trace back the path, they will meet at the radiant.

流星虽由其辐射点发出，待我们察觉到时，流星可能已离开辐射点，所以流星其实是可以从天空中任何一处中出现，只是流星的引伸路径会踏在辐射点而已。

## How to Observe Meteor Shower?

### 要如何观测流星群、流星雨

Find a dark, safe and unobstructed observing site.

找一个环境较暗、四周宽阔及安全的地方进行观测。

Check your direction and use the star chart to find the location of the radiant in the sky.

辨清方向之后利用星图找出流星群/雨辐射点的位置或星座。

Bring along star chart, red-light torchlight, food & drinks, jacket, ground-mat or sleeping bag.

出发前，紧记准备好星图、红灯电筒、地席、寒衣、水、食物等。

When you reach the observing site, find a place that is not easily disturbed by others.

到达观测地点后，找一处不易被别人骚扰的地方安顿。

Find a comfortable position to sit or lie down while waiting for the meteor to appear. The best position is to lie down flat on the ground so that you will cover the maximum area of the sky.

找个舒适的姿势躺下或坐下观看即可。最佳观测姿势是卧躺在地上。紧记要极目远望、眼顾四方。

All you need to enjoy a meteor shower is just your naked eyes.

No equipment is needed!

观赏流星并不需要任何仪器，肉眼就是最佳的观测工具！

### **Zenith Hourly Rate (ZHR) 中天每小时数目**

ZHR of a meteor shower is the number of meteor an observer would see in an hour under a dark sky with limiting magnitude of 6.5 and if the radiant was in the zenith. In reality the rate which can effectively be seen is always lower as the radiant is closer to the horizon and it also depends on the local weather condition.

中天每小时数目是指当流星群/雨极盛时，假设辐射点位于中天，天气状况良好，极限星等为6.5等，每小时于整个天空中出现的流星数目。须留意的是在现实观测中，辐射点很少会在中天的位置，还有天气状况的因素，我们实际可看到的流星数目通常会比这个数字为少。

# Meteoroid, Meteor and Meteorite

## Meteoroid 流星体

A meteoroid is a solid object – usually are dust particles or debris from comets – that floats around in space.

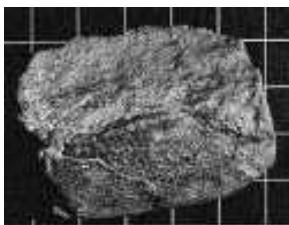
流星体是在太空浮游的沙石、冰块及尘埃。一般来自彗星。



## Meteor 流星

When meteoroid enters and burns in the Earth's atmosphere, the visible streak in the sky is known as a meteor.

流星是流星体与空气摩擦、燃烧而产生短暂发光的痕迹。



## Meteorite 陨石

A meteorite is the meteoroid that survives and reaches Earth's surface.

陨石是无法烧尽的流星体坠落到地面上。

# 流星、流星群及流星雨

流星或偶现流星是没有时间和方向可言。

流星群及流星雨的出现是有固定的时间和方向。在固定的日子中，从固定的辐射点向四面八方飞溅。

流星群及流星雨唯一不同的是：

- 流星群的中天每小时数目是在 200 颗以下
- 流星雨的中天每小时数目是在 200 颗以上

## Why there are more Meteors after Midnight?

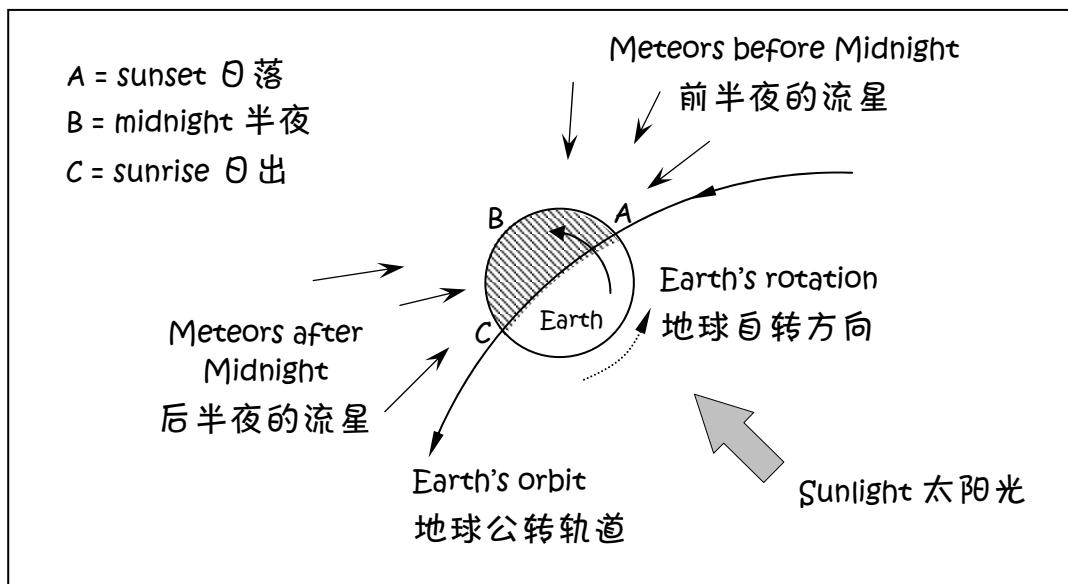
### 为什么后半夜的流星比前半夜多？

When Earth orbit around the Sun, basically meteoroids enter the Earth's atmosphere from all direction. The velocity of Earth around the Sun is about 30 km/s and the meteoroids' velocity is averagely 40 km/s.

Refer to the diagram, before midnight, the meteors are catching up with Earth from the back, hence the velocity of the meteor will be the different between the Earth's orbital velocity and the meteoroids' velocity, which is roughly 10 km/s.

After midnight, the meteors are heading straight to Earth, so the velocity now is the total of both the Earth and meteoroids' velocity, which is equal to 70 km/s.

Hence, before midnight, only those meteoroids moving faster than Earth will catch up, so the amount of meteor seen is lesser. Also, the velocity of the meteor is lower before midnight, so the meteor will be dimmer during this time.



地球在绕太阳前进时，流星体从四面八方闯入地球大气层的机会大致上是均等的。地球的自转速度并不高，但绕太阳公转的速度却可达每秒 30 公里，而流星体的速度平均为每秒 40 公里。

参考上图会发现到半夜前的这一段时间里，进入地球大气层的流星是从地球运转方向的“后面”追上来。此时流星体的速度是流星速度和地球速度之差，约每秒 10 公里。这是前半夜流星出现的情况。

后半夜这段时间里，进入地球大气层的流星体是迎着地球前进方向而来的，因此它的速度是流星速度和地球速度之和，约每秒 70 公里。

所以半夜之前，只有那些速度快的流星体才能追上地球。这时流星的速度一般上来说都不高，也不明亮。半夜之后，流星体与地球迎面相撞，速度不管快慢，只要出现在地球前进方向上都能进入地球大气层。所以不仅流星数量多，相对速度也快，也就显得更明亮了。