

absolute zero 绝对零度

It is the zero point of the ideal gas temperature scale, denoted by 0 degree on the Kelvin and Rankine temperature scales, which is equivalent to 273.15 and 459.67. For most gases there is a linear relationship between temperature and pressure, i. e., gases contract indefinitely as the temperature is decreased. Theoretically, at absolute zero the volume of an ideal gas would be zero and all molecular motion would cease. In actuality, all gases condense to solids or liquids well above this point. Although absolute zero cannot be reached, temperatures within a few billionths of a degree above absolute zero have been achieved in the laboratory. At such low temperatures, gases assume a nontraditional state, the Bose-Einstein condensate.

是指可能达到的最低温度。在绝对零度下，原子和分子拥有量子理论允许的最小能量。绝对零度也称开尔文温度标（简称开氏温标）的零度。开氏温标的一个单位与摄氏 1 度的大小是一样的。

Example

1. *Absolute zero* is the least possible temperature for all substances.
绝对零度是指所有物质的最低可能温度。
2. At *absolute zero* the molecules of any substance possess no heat energy.
在绝对零度下，任何物质的分子不具有热能。
3. A figure of -273.15°C is generally accepted as the value of *absolute zero*.
 -273.15°C 是普遍接受的绝对零度值。

accretion disk 吸积盘

A disk of gases or other interstellar matter around a black hole, neutron star, or other celestial body, formed by the gravitational attraction of the interstellar matter to the celestial body.

指由环绕黑洞、中子星或其它天体的气体或其它星际物质组成的盘状物；它是在星际物质对天体的万有引力作用下形成的。

Example

1. In our own solar system, the planets and asteroids formed from the *accretion disk* as the sun grew in the embryo core.

在我们自己的这个太阳系中，行星和小行星是在太阳尚在胚核中成长时由吸积盘形成的。

2. *Accretion disk* is a relatively flat sheet of gas and dust surrounding a newborn star, a black hole, or any massive object growing in size by attracting material

吸积盘是相对扁平的气体 and 尘埃，它包围着新生的星体、黑洞或所有通过吸引物料来增长体积的巨型物体。

Word Bank

black hole 黑洞

neutron star 中子星

interstellar matter 星际物质

celestial body 天体

embryo core 胚核

acid rain 酸雨

Acid rain is defined as any rainfall that has an acidity level beyond what is expected in non-polluted rainfall. In essence, any precipitation that has a pH value of less than 5.6 is considered to be acid precipitation.

One of the main causes of acid rain is sulphur dioxide. Natural sources, which emit this gas, are volcanoes, sea spray, rotting vegetation and plankton. However, the burning of fossil fuels, such as coal and oil, are largely to be blamed for approximately half of the emissions of this gas in the world. When sulphur dioxide reaches the atmosphere, it oxidizes to first form a sulphate ion. It then becomes sulphuric acid as it joins with hydrogen atoms in the air and falls back down to earth. Oxidation occurs the most in clouds and especially in heavily polluted air where other compounds such as ammonia and ozone help to catalyze the reaction, converting more sulphur dioxide to sulphuric acid. However, not the entire sulphur dioxide is converted to sulphuric acid. In fact, a substantial amount can float up into the atmosphere, move over to another area and return to earth unconverted.

指被非天然物质酸化 (pH 3.0 ~ 5.5) 的雨水。它是由于燃烧煤和油产生的氮和硫的氧化物污染大气的结果。美国测定的酸雨成分中, 硫酸占 60%, 硝酸占 32%, 盐酸占 6%, 其余是碳酸和少量有机酸。据统计, 全球每年排放进大气的二氧化硫约 1 亿吨, 二氧化氮约 5000 万吨, 所以, 酸雨主要是由人类生产活动和生活造成的。酸雨给地球生态环境和人类社会经济都带来严重的影响和破坏。

Example

1. *Acid rain* and the dry deposition of acidic particles are

known to contribute to the corrosion of metals and deterioration of stone and paint on buildings, statues, and cultural objects.

众所周知，酸雨及干燥的酸性颗粒沉淀物可腐蚀金属并使石雕艺术品、雕像、文物受到严重损坏。

2. Rain as acidic as lemon juice fell in Wheeling, West Virginia, and many lakes in New York State are dying from *acid rain*.

像柠檬汁一样酸的雨水降落在西弗吉尼亚州的惠灵市，在纽约州许多湖泊都因酸雨的危害而正在衰亡成使生物消亡的死水。



Word Bank

fossil fuels 矿物燃料

volcano 火山

plankton 浮游生物

sulphur dioxide 二氧化硫

sulphuric acid 硫酸

nitric acid 硝酸

hydrochloric acid 盐酸

nitrogen dioxide 二氧化氮

corrosion 腐蚀

albedo 反照率

It is the reflectivity of the surface of a planet, moon, asteroid, or other celestial body that does not shine by its own light. Albedo is measured as the fraction of incident light that the surface reflects back in all directions. A perfect reflector by definition has an albedo of unity, i. e. , all the incident light is reflected; a body that reflects no light at all would have an albedo of zero. Real surfaces have albedos between these values. The albedos of planets, moons, and asteroids provide valuable information about the structure and composition of their surfaces. The dark regions on the earth's moon give it the very low average albedo of 0. 07, while highly reflective clouds give Venus an albedo of 0. 85, the highest of any body in the solar system.

用于度量天体的反射率。全反射表面的反照率是 1 能吸收全部入射光的黑色表面的反照率为零。金星由于被白云覆盖而有较高的反照率:——0. 85 水星没有大气 只有岩质表面 其反照率仅 0. 11。地球的反照率是 0. 37。

Example

1. *Albedo* is a measure of the reflecting power of a non-luminous surface.

反照率是非发光表面反光性能的度量尺度。

2. *Albedo* is expressed as the ratio of energy reflected in all directions to total incident energy.

反照率用所有方向上反射的能量与总入射能量之比来表示。

anthropic principle 人择原理

Weak Anthropic Principle (WAP): The observed values of all physical and cosmological quantities are not equally probable but they take on values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirements that the Universe be old enough for it to have already done so.

Strong Anthropic Principle (SAP): The Universe must have those properties that allow life to develop within it at some stage in its history. Because:

1. There exists one possible Universe ‘designed’ with the goal of generating and sustaining ‘observers’.
2. Observers are necessary to bring the Universe into being.
3. An ensemble of other different universes is necessary for the existence of our Universe

Final Anthropic Principle (FAP): Intelligent information processing must come into existence in the Universe, and, once it comes into existence, it will never die out.

人择原理是宇宙中生命（特别是人类生命）的存在可以对当前宇宙的状态和宇宙进入当前状态的方式施加约束的一种思想。用一个例子可以最好地说明人择原理概念的威力。我们要能存在 就必须有一颗恒星（太阳）和一颗在适当距离围绕它运动的行星（地球），而行星必须是由合适的化学元素混合物（特别是要有碳、氮、氧和大爆炸遗留下来的原始氢）构成的。这些元素在生命过程中起着关键的作用。

弱人择原理：物理学和宇宙学的所有量的观测值，不是同等可能的；它们偏爱那些应该存在使碳基生命得以进化的地域以及宇宙应该足够年老以便做到这点条件所限定

的数值。

强人择原理：宇宙必须具备允许生命在其某个历史阶段得以在其中发展的那些性质。

最终人择原理：智能生命搜寻必然会发现宇宙中有智能生命存在，而且一旦存在便将永远不会消失。



Example

1. This statement and variants of this statement are the gist of the *anthropic principle*.

这一论点及其它论点成为人择原理的主要内容。

2. Note that the *anthropic principle* is probably true and says that there is nothing mysterious about why our Universe is special.

要注意的是，人择原理可能是正确的，它认为我们的宇宙为何如此特殊并没有什么神秘的。



Word Bank

weak anthropic principle	弱人择原理
strong anthropic principle	强人择原理
final anthropic principle	最终人择原理
carbon-based life	碳基生命
gist	要旨 主要内容
universe	宇宙

astrophysics 天体物理学

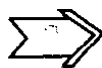
Application of the theories and methods of physics to the study of stellar structure, stellar evolution, the origin of the solar system, and related problems of cosmology. The distinction between astrophysics and modern astronomy is disappearing in scientific usage.

物理学在认识宇宙空间包括恒星及其他天体在内的一切事物以及宇宙本身规律中的应用。天体物理学发端于用光谱学研究恒星，这导致温度和物质成分的测量。天体物理学能够研究处在地球上达不到的宇宙中极端（温度、压力和密度）条件下的物质。



Example

1. *Astrophysics* is a branch of astronomy that applies the laws of physics to the study interstellar matter and the stars, their constitution, evolution, luminosity.
天体物理学是天文学的一门分支学科，它应用物理定律研究星际物质和恒星的结构、演化和光度。
2. The Center for *Astrophysics* studies the origin, evolution, and ultimate fate of the universe.
天体物理学中心研究宇宙的起源、演化和最终命运。



Word Bank

stellar evolution 天体演化
solar system 太阳系
astronomy 天文学

atomic clock 原子钟

Electric or electronic timekeeping device that is controlled by atomic or molecular oscillations. Using the oscillations of atoms or molecules can attain much greater accuracy. Because the frequency of such oscillations is so high, it is not possible to use them as a direct means of controlling a clock. Instead, a highly stable crystal oscillator whose output is automatically multiplied and compared with the frequency of the atomic system controls the clock. Errors in the oscillator frequency are then automatically corrected. The cesium-beam clock is the most accurate standard of atomic time currently in use; it is estimated that such a clock would gain or lose less than a second in three million years. Prototypes of atomic clocks using other kinds of atoms, such as hydrogen or beryllium, could be thousands of times more accurate even than today's cesium clocks. Current atomic clocks using the hydrogen atom maser can attain an error rate of about one part in 2 quadrillion.

以原子的规则振动为基础的各种计时装置的统称。第一个原子钟是美国国家标准局在 1948 年研制的，它依据的是氮分子中前后摆动的氮原子每秒 23 870 次的振动频率。它又叫做氮钟。

今天的标准原子钟是利用铯原子的规则振动为基础的计时装置。这类原子钟也叫做铯钟；其精度达到 10^{13} 分之一（10 万亿分之一）或 316 000 年误差 1 秒。

利用氢原子的辐射研制出了更精确的钟，叫做氢脉泽钟。这种类型的钟有可能达到 3 亿年差 1 秒的精度。

Example

1. *Atomic clock* is a clock whose frequency of operation is controlled by the frequency of an atomic or molecular process.

原子钟是一种工作频率由原子或分子过程的频率来控制的时钟。

2. Global positioning system (GPS) satellites, the Internet, and other telecommunication networks require precision timekeeping. For these applications, an *atomic clock* offers accuracy.

全球定位系统卫星、因特网和其他一些通信网络系统要求保持精确的计时。对于这些应用场合，原子钟都能提供精确的计时。

Word Bank

crystal oscillator 晶体振动器

atomic oscillation 原子振动

cesium-beam clock 铯钟

hydrogen atom maser 氢脉泽钟

global positioning system 全球定位系统

barred spiral galaxy 棒旋星系

In about a third of spiral galaxies, the arms spiral out, not from the center, but from a straight bar of stars, gas, and dust that extends from both sides of the bright nucleus. Hubble classified these barred spirals into sub-groups “a” to “c” in order of increasing openness of the arms, but with a “B” for barred inserted: “SBa”, “SBb”, “SBc”. Here are examples of these three sub-groups of barred spiral galaxies.

A new image from the Hubble telescope first posted on “Astronomy Picture of the Day” reveals a barred spiral galaxy with a starburst ring near its center, where new stars are being formed.

一种有棒状结构贯穿星系核的漩涡星系。在星系的分类中，以符号 SB 表示，以区别于正常螺旋星系 S。在全天的亮星系中，棒旋星系约占 15%。当统计到较暗的星系时，棒旋星系的比例提高到 25%。棒旋星系在质量、光度和光谱上，在成员天体的星族类型，气体和尘埃的分布，星系盘和星系晕的结构以及空间分布的特征等方面，都和正常的螺旋星系相似。按照哈勃的分类法和沃库洛的分类法，棒旋星系可分为三类：正常棒旋星系 SBa、SBb 和 SBc；透镜型棒旋星系 SB0；不规则棒旋星系 SBd 和 SBm。

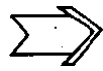
Example

1. There are many basic problems to be solved about the *barred spiral galaxy*, such as how did the rod structure formed and what role did play in the evolution of the galaxies.

棒旋星系有许多基本问题尚待解决，如棒状结构是怎样形成的，它在星系演化过程中起什么作用等

2. Spiral galaxy can be divided into two parts: normal vortex galaxy and *barred spiral galaxy*.

螺旋星系可分为正常漩涡星系和棒旋星系两种。



Word Bank

galactic nucleus 星系核

spiral galaxy 漩涡星系

bright galaxy 亮星系

galactic disk 星系盘

galactic halo 星系晕

normal barred spiral galaxy 正常棒旋星系

lenticular barred spiral galaxy 透镜型棒旋星系

irregular barred spiral galaxy 不规则棒旋星系

normal vortex galaxy 正常漩涡星系

binary stars 双星

Binary stars are pairs of stars that, because of their mutual gravitational attraction, orbit around a common Center of Mass. If a group of three or more stars revolve around one another, it is called a multiple system. It is believed that approximately 50 percent of all stars belong to binary or multiple systems. Systems with individual components that can be seen separately by telescope are called visual binaries or visual multiples. The nearest "star" to our solar system, Alpha Centauri, is actually our nearest example of a multiple star system, it consists of three stars two very similar to our Sun and one dim, small, red star orbiting around one another.

Most stars are found in groups of stars that are gravitationally bound with each other. The majority of these stars are found in binary systems, which are systems of two stars in orbit around a common center of mass.

One can classify binary stars based on their appearance from earth. Stars that are far enough apart to be distinguished from each other are known as visual binaries. Other binaries are too close and far away to be seen separately but can distinguished using the Doppler shift of their spectra. These are spectroscopic binaries.

In rare instances, such as with the star Algol the binary stars are close enough so that the eclipse one another. In this case, one can calculate not only the mass of the binary star systems, but also the radiation of the stars.

两颗彼此有物理联系并在共同引力作用下相互环绕作轨道运行的恒星组成的双星系统。双星系统的两颗恒星通常遵守开普勒定律、沿着围绕系统质心的椭圆轨道运

动。大多数恒星是在双星或更复杂的聚星系统中。双星在天体物理研究中极为重要，因为它们轨道的分析提供了直接测定恒星质量的惟一方法。

双星是宇宙间相距很近的两颗星体，两颗星都称为双星的子星。其中较亮的那颗星又叫主星，较暗的一颗又叫伴星。也有把质量大的叫主星，质量小的叫伴星的。在恒星世界中，双星是很普遍的现象。它是规模最小的恒星集团。



Example

Some *binary stars*, which strongly emit X-rays, may have black hole companions.

某些强烈辐射 X 射线的双星可能是具有黑洞的子星。



Word Bank

companions 子星

primary star 主星

secondary star 伴星

close binary 密近双星

radio binary 射电双星

eruptive binary 爆发双星

binary pulsar 脉冲双星

x-ray binary X 线双星

black dwarf 黑矮星

A black dwarf is the final phase in the stellar evolution of white dwarfs. Such stars have exhausted their nuclear energy sources; thus any light they produce is from gravitational contraction. The cold, dark hulks that remain when this energy is expended are called black dwarfs. Because they are small and emit no light, no black dwarfs have yet been discovered. 不再辐射任何光的、冷的、死亡了的恒星。恒星在核能耗尽后，靠引力收缩供能，等收缩到原半径的百分之一后，就变成了一个中心密度很高、仅靠剩余热量发光的天体，随着表面温度逐渐降低，慢慢成为黑矮星。



Example

1. *Black dwarfs* are difficult to detect because they emit no radiation.

黑矮星没有辐射，因此很难探测。

2. *Black dwarf* is the final stage of a white dwarf when it is devoid of light or heat.

黑矮星是白矮星的最后阶段，完全没有光和热。



Word Bank

white dwarf 白矮星

gravitational contraction 引力收缩

stellar evolution 天体演化

black hole 黑洞

An extremely small region of space-time with a gravitational field so intense that nothing can escape, not even light.

Black holes are believed to be the final stage in the collapse of a dying star, which was very massive.

Black holes are the evolutionary endpoints of stars at least 10 to 15 times as massive as the Sun. Any emitted photons are trapped into an orbit by the intense gravitational field; they will never leave it. Because no light escapes after the star reaches this infinite density, it is called a black hole.

But contrary to popular myth, a black hole is not a cosmic vacuum cleaner. If our Sun were suddenly replaced with a black hole of the same mass, the only thing that would change would be the Earth's temperature. To be "sucked" into a black hole, one has to cross inside the Schwarzschild radius. At this radius, the escape speed is equal to the speed of light, and once light passes through, even it cannot escape. The Schwarzschild radius can be calculated using the equation for escape speed.

是指引力极强，没有任何东西能从该处逃逸，甚至光线也不例外的宇宙空间。黑洞可从大质量恒星的“死亡”中产生。

黑洞的基本特征为具有一个封闭的视界，此视界亦即黑洞的边界，外来的物质与辐射可以进入视界以内，但视界内的物质却不能出去。

由于黑洞无法辐射出任何电磁波，无法对其本身进行直接观测。因此在过去它一直只存在于理论中，不过由于中子星的发现，它的存在已被肯定。

目前所知的第一个黑洞为天鹅座的 X-1，它的质量为太

阳的 20倍 距离我们有 6000 光年。其中发出的神秘 X 光源是由发射出强烈 X 光的主星和看不到的伴星所组成。这个伴星具有太阳 14倍大的质量，天文学家猜测它是一个黑洞。

Example

1. *Black holes* are believed to be the *final stage* in the collapse of a dying star which was very massive.
黑洞被认为是即将死亡的大质量恒星的演化末态。
2. The government created a bureaucratic *black hole* that swallows up individual initiative.
政府制造出一个吞噬个人创造性的官僚主义大黑洞。

Word Bank

gravitational field 引力场

collapse 坍缩

Schwarzschild radius 施瓦兹希爾半径

final stage 末态

bureaucratic black hole 官僚主义黑洞

escape 逃逸

escape speed 逃逸速度