

TPO 50 – 1 American Railroads 美国铁路

In the United States, railroads **spearheaded** the second phase of the transportation **revolution** by **overtaking** the previous importance of canals. The **mid-1800s** saw a great expansion of American railroads. The major cities east of the Mississippi River were linked by a spiderweb of **railroad tracks**. Chicago's growth illustrates the impact of these rail links. In 1849 Chicago was a village of a few hundred people with **virtually** no rail service. By 1860 it had become a city of 100,000, served by eleven railroads. Farmers to the north and west of Chicago no longer had to ship their grain, livestock, and dairy products down the Mississippi River to New Orleans; they could now ship their products directly east. Chicago **supplanted** New Orleans **as** the interior of America's **main commercial hub**.

在美国，铁路超越了运河在此之前的重要性，**引领**着交通运输革命第二阶段的发展。**19世纪中叶**见证了美国铁路的大扩张。密西西比河以东的主要城市由蜘蛛网一样纷繁交错的**铁轨**连接起来。芝加哥的发展就能够说明这些铁路带来的影响。在**1849年**，芝加哥是一个只有几百人的小村庄，**几乎**没有铁路服务。到了**1860年**，芝加哥已经发展为一个有着**10万人口**的大城市，有**11条铁路**贯穿其中。芝加哥北部和西部的农民不再需要用船装载他们的谷物、牲畜和乳制品，沿着密西西比河一路向下，运送到新奥尔良；他们现在可以直接将他们的产品运送到东部。芝加哥取代了新奥尔良成为了美国内陆的**主要商业中心**。

The east-west rail lines **stimulated** the settlement and agricultural development of the Midwest. By 1860 Illinois, Indiana, and Wisconsin had **replaced** Ohio, Pennsylvania, and New York **as** the **leading** wheat-growing states. Enabling farmers to speed their products to the East, railroads increased the value of farmland and promoted additional settlement. In turn, population growth in agricultural areas **triggered** industrial development in cities such as Chicago, Davenport (Iowa), and Minneapolis, **for** the new settlers needed **lumber** for fences and houses and **mills** to grind wheat into flour.

东西向的铁路**促进了**美国中西部地区的移民和农业的发展。到**1860年**，伊利诺斯州、印第安纳州和威斯康星州已经取代了俄亥俄州、宾夕法尼亚州和纽约市，成为了小麦的**主要**产地。铁路使农民加快了将农产品运输到东部的速度，提升了耕地的价值，并催生出了许多新的定居点。转而，农业地区的人口增长促进了芝加哥、达文波特（美国艾奥瓦州）、明尼阿波利斯等城市的工业发展，这是因为新移民需要**木材**来建造栅栏和房屋，需要用**磨坊**来把小麦磨成面粉。

Railroads also **propelled** the growth of small towns along their routes. The Illinois Central Railroad, which had more track than any other railroad in 1855, made money not only from its traffic but also from **real estate speculation**. Purchasing land for stations along its path, the Illinois Central then **laid out** towns around the stations. The selection of Manteno, Illinois, as a stop of the Illinois Central, for example, transformed the site from a **crossroads** without a single house in 1854 into a **bustling** town of nearly a thousand in 1860, **replete with** hotels, lumberyards, grain elevators, and gristmills. By the Civil War (1861–1865), few **thought of** the railroad-linked Midwest **as** a frontier region or **viewed** its inhabitants **as** pioneers.

铁路也推动了沿线小城镇的发展。**1855年**，伊利诺斯州中央铁路公司比其他铁路有更多轨道，它不仅从交通运输中赚钱，还能从投资房地产中获利。伊利诺斯州中央铁路公司沿着铁轨

批注 [1]: spearhead

- n. 矛头；先锋；先锋部队
- vt. 带头；做先锋

批注 [2]: overtake

- vt. 赶上；压倒；突然来袭
- vi. 超车

批注 [3]: railroad tracks

- 铁轨；铁路轨道

批注 [4]: supplant

- 英 [sə'plɑ:nt] 美 [sə'plænt]
- vt. 代替；排挤掉

批注 [5]: trigger

英 ['trɪgə] 美 ['trɪgər]

- n. 扳机；起因，引起反应的事；触发器，引爆装置
- v. 触发，引起；开动（装置）

批注 [6]: propel

英 [prə'pel] 美 [prə'pel]

- vt. 推进；驱使；激励；驱策

批注 [7]: real estate speculation

[ˈri:əl ɪ'steɪt ,spekju'leɪʃn]

- 房地产投机

批注 [8]: lay out

- 展示；安排；花钱；为...划样；提议

批注 [9]: replete with

[rɪ'pli:t wɪð]

- 充满

购买土地建造新的车站，接着就在车站的周围建造了城镇。例如，伊利诺斯州中央铁路公司选择曼蒂诺（伊利诺斯州一处地名）建造了车站，使这个小村庄从 1854 年一个寥无人烟的岔道口转变为了 1860 年将近有一千人的繁华小镇，酒店、贮木场、谷物升降机、磨坊随处可见。到内战时期（1861-1865），几乎没有人将铁路贯通的中西部地区看作是边疆地区，或是将那里的居民看成是拓荒者。

As the nation's first big business, the railroads transformed the **conduct** of business. During the early 1830s, railroads, like canals, depended on financial aid from state governments. With the onset of economic depression in the late 1830s, however, state governments **scrapped** **overly ambitious** railroad projects. Convinced that railroads burdened them with high taxes and **blasted** hopes, **voters** turned against state aid, and in the early 1840s, several states **amended** their **constitutions** to **bar** state funding for railroads and canals. The federal government took up some of the **slack**, but federal aid did not provide a major stimulus to railroads before 1860. **Rather**, part of the burden of finance passed to city and **county** governments in agricultural areas that wanted to attract railroads. Such **municipal** governments, for example, often gave railroads rights-of-way, **grants of land for stations**, and public funds.

作为全国的第一大产业，铁路改变了企业的经营方式。在 19 世纪 30 年代早期，铁路，就像运河一样，依靠州政府的财政支持才能发展。然而，在 19 世纪 30 年代后期，经济大萧条的开始，使得州政府取消了规模过于宏大的铁路建设项目。选民们相信铁路让他们背负重税，让他们失去希望，转而反对政府为铁路建设提供财政援助，在 19 世纪 40 年代早期，一些州修改了自己的宪法，禁止为铁路和运河建设提供国家资金。联邦政府弥补了一些资金缺口，但是联邦政府的援助并没有成为 1860 年之前促进铁路发展的主要资金力量。相反，部分财政负担转移到了希望在当地建设铁路的农业地区的市、县政府身上。比如说，这样的市政府通常会给铁路公司路权、车站用地许可和公共资金。

The **dramatic** expansion of the railroad network in the 1850s, however, **strained** the financing capacity of local governments and required a turn toward private investment, which had never been absent from the picture. Well aware of the economic benefits of railroads, individuals living near them had long purchased railroad stock **issued by** governments and had directly bought stock in railroads, often paying by contributing their labor to building the railroads. But the large railroads of the 1850s needed more capital than such small investors could generate. Gradually, the center of railroad financing shifted to New York City, and in fact, it was **the railroad boom of the 1850s** that **helped make Wall Street in New York City the nation's greatest capital market**. The stocks of all the leading railroads were traded on the floor of the **New York Stock Exchange** during the 1850s. In addition, the growth of railroads turned New York City into the center of modern investment firms. The investment firms **evaluated** the stock of railroads in the smaller American cities and then found purchasers for these stocks in New York City, Philadelphia, Paris, London, Amsterdam, and Hamburg. Controlling the flow of funds to railroads, the investment bankers began to **exert influence over** the railroads' **internal affairs** by supervising administrative reorganizations in times of trouble.

批注 [10]: conduct

- v. 组织，实施，进行；指挥（音乐）；带领，引导；举止，表现；传导（热或电）
- n. 行为举止；**管理（方式），实施（办法）**；引导

批注 [11]: scrap

- n. 碎片；残余物；打架；少量
- vt. 废弃；使解体；拆毁
- adj. 废弃的；零碎的
- vi. 吵架

批注 [12]: overly

- adv. 过度地；极度地

批注 [13]: blast

- n. 爆炸；冲击波；一阵
- vi. 猛攻
- vt. 爆炸；**损害；使枯萎**

批注 [14]: county

- n. 郡，县

批注 [15]: municipal

- adj. 市政的，市的；地方自治的

批注 [16]: strain

- n. 张力；拉紧；负担；扭伤；血缘
- vi. 拉紧；尽力
- vt. 拉紧；滥用；滤去；竭力
- n. （植物、动物的）品种；种类

批注 [17]: exert

- 英 [ɪg'zɜ:t] 美 [ɪg'zɜ:rt]
- vt. 运用，发挥；施以影响

然而，1850年铁路网络的急剧扩张，给当地政府的融资能力造成了不小的压力，铁路资金的需求转向了私人投资方向，而私人投资一直以来都是铁路资金来源的一部分。住在铁路附近的人很清楚铁路的经济效益，他们长期购买政府发行的铁路股票，并直接从铁路公司购买股票，他们通常通过参与铁路建设来支付股票费用。但是，19世纪50年代的大型铁路公司需要比这些小投资者所提供的资金更多的资本。渐渐地，铁路融资的中心转移到了美国纽约，事实上，是19世纪50年代铁路的蓬勃发展使纽约的华尔街成为了美国最大的资本市场。50年代所有主要铁路的股票都在美国纽约证券交易所中进行。此外，铁路的发展使纽约成为了现代投资公司的中心。这些投资公司评估了美国规模较小的一些城市的铁路股票，然后在纽约、费城、巴黎、伦敦、阿姆斯特丹和汉堡寻找这些股票的购买者。为了控制资金流向铁路，投资银行家们开始在困难时期通过监督行政重组的方式对铁路公司的内部事务施加影响。

TPO 50 – 2 The Achievement of Brazilian Independence 巴西独立的成功

In contrast to the political **anarchy**, economic **dislocation**, and military **destruction** in Spanish America, Brazil's **drive toward** independence from Portugal **proceeded*** as a relatively bloodless transition between 1808 and 1822. The idea of Brazilian independence first arose in the late eighteenth century as a Brazilian reaction to the Portuguese policy of **tightening** political and economic control over the colony in the **interests** of the mother country. The first significant **conspiracy** against Portuguese rule was organized from 1788–1799 in the province of Minas Gerais, where **rigid governmental control over** the production and prices of gold and diamonds, as well as heavy taxes, caused much discontent. But this conspiracy **never went beyond the stage of discussion** and was easily discovered and crushed. Other conspiracies in the late eighteenth century as well as a brief **revolt** in 1817 reflected the influence of **republican** ideas over sections of the elite and even the **lower strata** of urban society. All proved **abortive*** or were soon crushed. **Were it not for an accident of European history, the independence of Brazil might have been long delayed.**

与西班牙美洲地区的无政府状态、经济混乱和军事破坏相反，在 1808 年至 1822 年间，巴西脱离葡萄牙走向独立则相对来说是一次不流血的政变。巴西独立的想法最早是在 18 世纪末产生的，葡萄牙为了自己国家的**利益**，**加强**对巴西殖民地政治和经济的控制，而巴西独立的想法正是对葡萄牙这种做法的反抗。巴西在 1788 年到 1799 年间，在米纳斯吉拉斯州境内，组织了对葡萄牙统治的第一次重要的反叛，在那里**严苛的政府控制**了黄金和宝石的生产及价格，并让人民负担沉重的捐税，引起了诸多的不满。但这次阴谋**从没有诉诸行动**，它很快就被发现并被镇压了。18 世纪末期发动的其他反叛，以及 1817 年的一次短暂的**起义**，都反映出独立思想对一些精英，甚至是对**下层社会**所造成的影响。所有的这些叛变都失败了，或很快就被镇压了。**如果不是欧洲历史上的一次意外事件，巴西的独立可能会延后很久。**

The French invasion of Portugal in 1807 **followed by** the flight of the Portuguese court (**sovereign** and government officers) to Rio de Janeiro brought large benefits to Brazil. Indeed, the transfer of the court in effect signified **achievement of Brazilian independence**. The Portuguese prince and future King João VI opened Brazil's ports to the trade of friendly nations, **permitted the rise of local industries**, and founded the Bank of Brazil. In 1815 he elevated Brazil to the legal status of a kingdom **coequal with** Portugal. In one sense, however, Brazil's new status signified the **substitution** of one dependence for another. Freed from Portuguese control, Brazil came under the economic dominance of England, which obtained major **tariff concessions** and other privileges by the Strangford Treaty of 1810 between Portugal and Great Britain. The **treaty** provided for the **importation** of British manufactures into Brazil and the **export** of Brazilian agricultural produce to Great Britain. One result was an **influx of** cheap machine-made goods that **swamped** the handicrafts industry of the country.

法国于 1807 年入侵葡萄牙，随后葡萄牙政府（最高统治者和政府官员）逃到了里约热内卢，这给巴西带来了巨大的利益。确实，政府的转移事实上意味着**巴西的独立的实现**。葡萄牙王子兼未来的国王若奥六世，开放了巴西的港口，与友好国家进行贸易往来，**使地方产业的崛起成为可能**，并建立了巴西银行。在 1815 年，他将巴西提升为巴西王国，使之与葡萄牙**享有同**

批注 | 18]: anarchy

•n. 无政府状态; 混乱; 无秩序

批注 | 19]: dislocation

•n. 转位; 混乱; [医] 脱臼

批注 | 20]: destruction

•n. 破坏, 毁灭; 摧毁

批注 | 21]: proceed

•vi. 开始; 继续进行; 发生; 行进

•n. 收入, 获利

批注 | 22]: conspiracy

英 [kən'spɪrəsi] 美 [kən'spɪrəsi]

•n. 阴谋; 共谋; 阴谋集团

批注 | 23]: republican

•adj. 共和国的; 共和政体的; 共和主义的; 拥护共和政体的

•n. 共和主义者

批注 | 24]: abortive

英 [ə'bo:rtɪv] 美 [ə'bo:rtɪv]

•adj. 失败的; 流产的; 堕胎的

批注 | 25]: coequal

•adj. 同等的, 同权的

•n. 相互平等的人或事物

批注 | 26]: tariff

•n. 关税表; 收费表

•vt. 定税率; 征收关税

批注 | 27]: concession

•n. 让步; 特许(权); 承认; 退位

等的法律地位。然而，从某种意义上说，巴西的新地位意味着一种依存关系被另一种依存关系所替代。摆脱了葡萄牙的控制，巴西受到了英国经济的统治，英国通过 1810 年与葡萄牙签订的斯特兰福德条约，获得了重大的关税减让和其他特权。该条约规定了哪些英国商品可以进口到巴西以及哪些巴西农产品可以出口到英国。这导致的一个结果就是，大量廉价的机器制造的商品的涌入淹没了巴西的手工业。

批注 [28]: an influx of

-的大量涌入
-的大量汇集

Brazilian elites took satisfaction in Brazil's new role and the growth of educational, cultural, and economic opportunities for their class. But the feeling was mixed with resentment toward the thousands of Portuguese courtiers (officials) and hangers-on who came with the court and who competed with Brazilians for jobs and favors. Thus, the change in the status of Brazil sharpened the conflict between Portuguese elites born in Brazil and elites born in Portugal and loyal to the Portuguese crown.

巴西的精英们对巴西的新角色以及精英阶层教育、文化、经济机会的增加感到满意。但这种情感中还夹杂着对数千名葡萄牙廷臣（官员）和与他们一道来的食客们的愤恨和不满，这些食客与巴西人竞争工作机会和利益。因此，巴西地位的变化加剧了出生在巴西的葡萄牙精英和出生在葡萄牙并忠于葡萄牙王室的精英之间的矛盾。

The event that precipitated the break with the mother country was the revolution of 1820 in Portugal. The Portuguese revolutionaries framed a liberal constitution for the kingdom, but they were conservative or reactionary in relation to Brazil. They demanded the immediate return of King João to Lisbon, an end to the system of dual monarchy that he had devised, and the restoration of the Portuguese commercial monopoly. Timid and vacillating, King João did not know which way to turn. Under the pressure of his courtiers, who hungered to return to Portugal and their lost estates, he finally approved the new constitution and sailed for Portugal. He left behind him, however, his son and heir, Pedro, and in a private letter advised him that in the event the Brazilians should demand independence, he should assume leadership of the movement and set the crown of Brazil on his head.

批注 [29]: precipitate

- v. 使（坏事等）突然发生；使突然陷入（某种状态）；使沉淀；猛抛，猛地落下；冷凝成为雨或雪等
- adj. 鲁莽的，仓促的；突如其来；猛地落下的
- n. 沉淀物

促成巴西与宗主国（葡萄牙）决裂的事件是 1820 年的葡萄牙资产阶级革命。葡萄牙的革命者为国家制定了自由宪法，但是在处理巴西关系方面他们显得很保守甚至反动。他们要求国王若奥六世立刻回到里斯本，结束他所制定的双君主制，并恢复葡萄牙商业垄断。国王若奥六世非常胆小和优柔寡断，他不知道该选择哪条路。廷臣们都渴望回到葡萄牙，回到他们所失去的家园，在廷臣施加的压力下，若奥六世最终批准了新宪法并乘船回到了葡萄牙。然而，他把他的儿子兼继承人佩德罗留在了巴西，并且在一封私信中，他劝告佩德罗如果巴西要求独立的话，他应该领导这场运动并将巴西的皇冠放到自己的头上（加冕成为巴西的皇帝）。

批注 [30]: assume

- 英 [ə'sju:m] 美 [ə'su:m]
- vi. 设想；承担；采取
 - vt. 假定；僭取；篡夺；夺取；擅用；侵占

Soon it became clear that the Portuguese parliament* intended to set the clock back by abrogating all the liberties and concessions won by Brazil since 1808. One of its decrees insisted on the immediate return of Pedro from Brazil. The pace of events moved more rapidly in 1822. On January 9, urged on by Brazilian advisers who perceived a golden opportunity to make an orderly transition to independence without the intervention of the masses, Pedro refused an order from the parliament to return to Portugal, saying famously, "I remain". On September 7, regarded by all Brazilians as Independence Day, he issued the even more

批注 [31]: parliament*

- n. 议会，国会

批注 [32]: concession

- n. 让步；特许（权）；承认；退位

批注 [33]: urge on

- 鞭策
- 敦促

celebrated proclamation, "Independence or death!" In December 1822, having overcome **slight** resistance by Portuguese **troops**, Dom Pedro was **formally** proclaimed constitutional Emperor of Brazil.

很快，葡萄牙议会就企图通过**废除**巴西自 1808 年以来所获得的一切自由和**特权**，来让时光倒流。其中一条**法令**要求佩德罗立即从巴西回来。事件的进展在 1822 年变得更快。1 月 9 日，巴西幕僚们**认为这是一个千载难逢的机会**能让巴西在排除干扰的情况下有序地过渡为独立的王国，在幕僚们的劝导下，佩德罗拒绝了葡萄牙议会要求他回到葡萄牙的命令，说出了那句著名的：“我将留在这里。” 9 月 7 日，在这个被巴西人定为独立日的日子，佩德罗**发布**了更为**著名的宣言**，“不独立，毋宁死！” 1822 年 12 月，在镇压了葡萄牙部队的**轻微**反抗之后，佩德罗**正式**加冕成为巴西的立宪制皇帝。

批注 | 34]: proclamation

英 [ˌprɒkləˈmeɪʃn] 美 [ˌpra:kliˈeɪʃn]

•n. 公告；宣布；宣告；公布

proclaim

英 [prəˈkleɪm] 美 [prəˈkleɪm]

•vt. 宣告，公布；声明；表明；赞扬

批注 | 35]: slight

•adj. 轻微的，少量的；脆弱的；细长的；不重要的

•vt. 轻视，忽略；怠慢

•n. 怠慢；轻蔑

TPO 50 – 3 Star Death 恒星的衰亡

Until the early- to mid-twentieth century, scientists believed that stars generate energy by shrinking. As stars contracted, it was thought, they would get hotter and hotter, giving off light in the process. This could not be the primary way that stars shine, however. If it were, they would **scarcely** last a million years, rather than the billions of years in age that we know they are. We now know that stars are fueled by nuclear fusion. Each time fusion takes place, energy is released as a **by-product**. This energy, **expelled** into space, is what we see as **starlight**. The fusion process begins when two hydrogen **nuclei** **smash together** to form a particle called the **deuteron** (a combination of a positive proton and a neutral neutron). Deuterons **readily** combine with additional protons to form helium. Helium, in turn, can fuse together to form heavier elements, such as carbon. In a **typical** star, merger after merger takes place until significant quantities of heavy elements are built up.

直到 20 世纪早期到中期, 科学家们一直都相信恒星是通过收缩产生能量的。人们认为, 随着恒星收缩, 它们会变得越来越热, 在这个过程中它们会发光。然而, 这可能不是恒星发光的主要方式。假如是这样的话, 它们几乎不可能存在一百万年, 而据我们所知, 它们一直存在了几十亿年。我们现在知道恒星是从核聚变中获得能量的。每当核聚变发生时, 能量就会作为**副产品**被释放。这些能量, 被喷射到太空中, 就成了我们所看到的**星光**。核聚变的过程开始时, 两个氢原子**碰撞在一起**, 形成了一个被称作**氘核**(正质子和中性中子的结合)的原子。氘核很容易与其他的质子结合形成氦。氦, 又会融合在一起形成更重的元素, 比如碳。在一个**典型的**恒星中, 合并融合的过程会不停地上演, 直到形成大量的重元素。

We must distinguish, at this point, between two different **stellar** types: Population I and Population II, the latter being much older than the former. These groups can also be distinguished by their locations. Our galaxy, the Milky Way, is shaped like a **flat disk** **surrounding** ^{vt.} a central **bulge**. **Whereas** Population I stars are found mainly in the galactic disk, Population II stars mostly **reside in** the central bulge of the galaxy and in the **halo** **surrounding** ^{vt.} this bulge.

就此, 我们必须区分两种不同的**恒星**类型: 星族 I 和星族 II, 后者比前者的年龄要更大。这些恒星群也可以根据它们所在的位置来区分。我们的星系, 银河系, 它的形状就像一个围绕着中央凸起的扁平圆盘。星族 I 的恒星主要位于银盘之上, 而星族 II 的恒星大部分都**位于**银河系中央凸起的部分, 以及凸起部分周围**的光晕**中。

Population II stars date to the early stages of the universe. Formed when the **cosmos** was filled with hydrogen and helium gases, they initially contained virtually no heavy elements. They shine until their **fusible** material is exhausted. When Population II stars die, their material is spread out into space. Some of this dust **is eventually incorporated into** newly formed Population I stars. Though Population I stars consist mostly of hydrogen and helium gas, they **also** contain heavy elements (heavier than helium), which comprise about 1 or 2 percent of their mass. These heavier materials are fused from the lighter elements that the stars have collected. Thus, Population I stars contain material that once belonged to stars from previous generations. The Sun is a good example of a Population I star.

批注 [36]: scarcely

英 ['skeəslɪ] 美 ['skersli]

•adv. 几乎不, 简直不; 几乎没有; 决不; 刚……就……; 仅仅, 刚刚; 勉强, 刚; **根本不可能**; 不可能, 不会

批注 [37]: by-product

•n. 副产品; 附带产生的结果; 意外收获

批注 [38]: expel

英 [ɪk'spel] 美 [ɪk'spel]

•vt. 驱逐; 开除; 排除; **排出**

批注 [39]: nucleus

英 ['nju:klɪəs] 美 ['nu:klɪəs]

•n. 核, 核心; 原子核
nuclei

英 ['nju:klɪəɪ] 美 ['nju:klɪ,ai]

•n. 核心, 核子; 原子核
(nucleus 的复数形式)

批注 [40]: bulge

•n. 胀; 膨胀; 凸出部分

•vt. 使膨胀; 使凸起

•vi. 膨胀; 凸出

批注 [41]: Whereas

[,wer'æz]

•conj. 然而; 鉴于

•n. 序言, 开场白; 条件语句

批注 [42]: galactic

英 [gə'læktɪk] 美 [gə'læktɪk]

•adj. 银河的; 乳汁的

星族 II 的恒星可以追溯到宇宙的早期阶段。这些恒星是在**宇宙**充满氢气和氦气的情况下形成的，它们最初几乎不含重元素。它们闪闪发光直到耗尽**易燃** adj. 物质。当星族 II 的恒星死亡的时候，它们所含的物质会分散到宇宙中。其中一些尘埃物质**最终并入了**最新形成的星族 I 的恒星中。虽然星族 I 的恒星的组成物质大部分是氢气和氦气，它们也含有重元素（比氦更重），这些重元素约占其质量的 1% 或 2%。这些较重的物质是由恒星所积聚的较轻的元素融合而成的。因此，星族 I 的恒星包含了属于前代恒星的物质。太阳就是一个很好的星族 I 恒星的例子。

What will happen when the Sun dies? In several billion years, our mother star will burn much brighter. It will **expend** more and more of its nuclear fuel, until little is left of its original hydrogen. Then, at some point in the far future, all nuclear reactions in the Sun's center will cease.

当太阳死亡的时候会发生什么？几十亿年后，我们的母星将燃烧变得更亮。它将**消耗**越来越多的核燃料，直到它原来所含的氢都所剩无几。然后，在遥远未来的某个时刻，太阳中心所有的核反应都将停止。

Once the Sun passes into its "postnuclear" phase, it will separate effectively into two different regions: an inner zone and an outer zone. While no more hydrogen fuel will remain in the inner zone, there will be a small amount left in the outer zone. Rapidly, changes will begin to take place that will serve to **tear** the Sun **apart**. The inner zone, its nuclear fires no longer burning, will begin to **collapse** under the influence of its own weight and will contract into a tiny hot core, dense and dim. **An opposite fate will await** the outer region, a loosely held-together ball of gas. A shock wave caused by the inner zone's contraction will send **ripples** through the dying star, pushing the stellar exterior's material farther and farther outward. The **outer envelope** will then grow rapidly, increasing, in a short interval, hundreds of times in size. As it expands, it will cool down by thousands of degrees. Eventually, the Sun will become a red giant star, cool and bright. It will be **so large** that it will occupy the whole space that used to be the Earth's orbit and **so brilliant** that it would be able to be seen with the naked eye thousands of light-years away. It will exist that way for millions of years, gradually releasing the material of its **outer envelope** into space. Finally, nothing will be left of the gaseous **exterior** of the Sun; all that will remain will be the hot, white core. The Sun will have become a white dwarf star. The core will shrink, giving off the last of its energy, and the Sun will finally die.

一旦太阳进入“后原子”阶段，它将明显分解成两个区域：内区和外区。尽管内区不会再有氢燃料，外区还会有少量残留。很快，将发生分解太阳的变化。原子火不再燃烧的内区将在自己的重力下**坍塌**，收缩成高密度、低亮度的微小热核。相反的命运在等待着外区，这是一个松散联系在一起的气球。内区收缩造成的冲击波在死去的恒星中造成**波纹**，把恒星的外部材料进一步向外推。**外围**将快速增大，在短期内增大数百倍。在扩展的同时，太阳的温度将下降几千度。最终，太阳将变成一个红巨星，寒冷而明亮。它变得如此巨大，将占据曾经是地球轨道的空间，又如此明亮，在几千光年以外都能用肉眼看到。它将以这样的方式存在几百万年，逐渐把**外围**的物质释放到太空。最终，太阳的外围气体跑得一丝不剩；剩下的只有白色的热核。这样，太阳就变成了一个白矮星。它的内核也会收缩，释放出最后的能量，太阳最终死去。

批注 | 43]: await

英 [ə'weɪt] 美 [ə'weɪt]

•vt. 等候，等待；期待

批注 | 44]: ripple

英 ['rɪpl] 美 ['rɪpl]

•n. 波纹；涟漪；[物] 涟漪

•vi. 起潺潺声

•vt. 在...上形成波痕

批注 | 45]: envelope

英 ['envələʊp; 'ɒnvələʊp]

美 ['envəloʊp, 'ɑ:nvəloʊp]

•n. 信封，封皮；包膜；[天] 包层；包迹

批注 | 46]: exterior

英 [ɪk'stɪəriəl] 美 [ɪk'stɪəriəl]

•adj. 外部的，外面的，外在的；（电影场景）室外的；外界

•n. （建筑）外部，表面；（人的）外型，外貌；（摄影）外景