



# Hawking

For Beginners

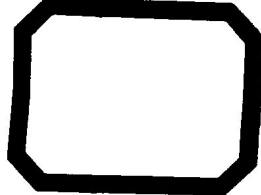
霍金

J. P. McEvoy and Oscar Zarate

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外语教学与研究出版社  
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F o r B e g i n n e r s

J. P. McEvoy and Oscar Zarate

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英汉对照  
• 世界人物画传



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**霍金**

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## 出版说明

即将过去的 20 世纪是人类文明空前进步的一个世纪,也是经历了两次世界大战洗礼的一个世纪。这个世纪人类揭开了原子的奥秘,引爆了原子弹和氢弹;这个世纪人类登上了月球,准备着探索火星;这个世纪人类对生命的认识由于 DNA 结构和克隆技术的发现而有了既令人兴奋又令人惶惑的飞跃;这个世纪飞机、卫星、电视、电脑和国际互联网使我们的世界变得如此地小;这个世纪推翻了我们原有的几乎所有关于语言、逻辑、认知、数学、经济甚至时空的观念,使这个世界变得那么丰富多彩。而人类之所以能取得这些空前的令人惊叹的成就,离不开一位位卓尔不群的伟大思想家、科学家和艺术家。在新旧世纪之交,外语教学与研究出版社出版这套英汉对照世界人物画传丛书因而具有了特殊的纪念意义。

这套丛书精挑细选了十位近、现代很有代表性的伟大人物,他们当中有生物进化论的创立者达尔文、相对论之父爱因斯坦、宇宙和时空理论的代表者霍金、存在主义哲学的集大成者萨特、精神分析学科最新权威拉康、国家资本主义经济理论的先驱凯恩斯、立体主义绘画大师毕加索和意识流文学巨匠乔伊斯。真可谓是群星璀璨。出版这套丛书既有益于普及自然科学和社会科学,提高人民素质,又符合外语教学与研究出版社“记载人类文明,沟通世界文化”的立社宗旨。因此可以看作是外研社对千禧年的一份献礼。

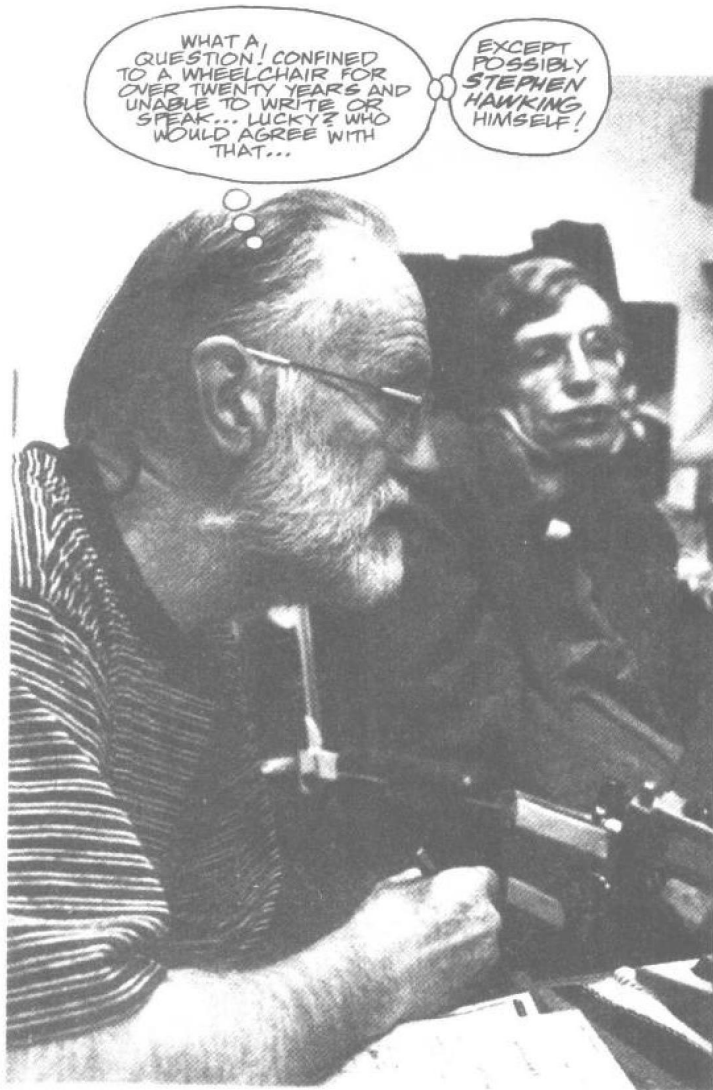
该套丛书最大的特点和优点在于深入浅出、图文并茂。当今世界电视、电影作为传媒统治性的繁荣可能宣告了读图时代的来临和注意力经济的盛行。这套丛书图文并茂的形式在某种意义上也是顺应时代发展需要的产物。我们希望,生动有趣、活泼幽默的插图配上浅显易懂的地道英文、忠实的中文对译以及简明扼要的注释会大大提高读者学习英语的兴趣,最终增强中国人在全球化时代掌握这个国际交流工具的信心。

最后需要说明的是,由于原作者的历史观点难免有所偏颇,编者虽已作一定修改,仍需读者审慎辨明。但瑕不掩瑜,从学习外语同时又拓展知识的角度看,本丛书无疑是一套难得的读物。



## The Luckiest Man in the Universe

On 19 October 1994, the author of this book interviewed Stephen Hawking. He began with a question that might seem daring, if not impertinent. Did Hawking consider himself lucky?



宇宙中最幸运的人

1994年10月19日,本书作者采访了史蒂芬·霍金。一上来他就问了一个大胆而又不失礼貌的问题:霍金是否认为自己是幸运的?

“这个问题问得好!二十多年来只能坐在轮椅上,不能写字,不能说话……幸运?谁会这么想……”

也许除了史蒂芬·霍金他自己!”

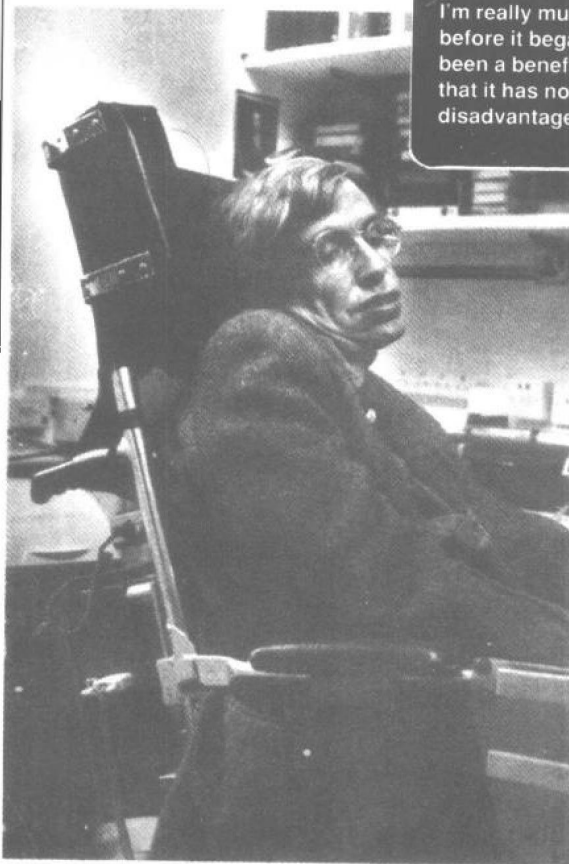
confine v. 限制, 禁闭

“除了运动神经元症以外,我同意,我在各方面都非常幸运。甚至疾病也算不上是什么打击。在多方帮助下,我已设法克服了疾病的影响。我很满意,即使有病,我仍取得了成功。

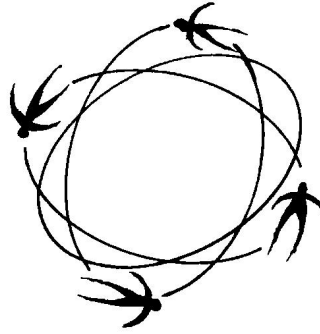
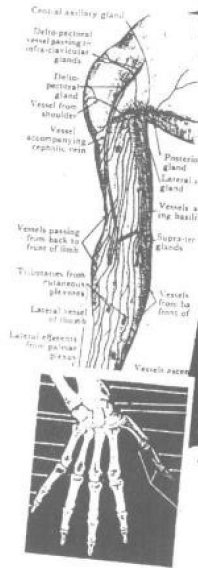
真的,我现在比得病之前快乐得多。不能说我从疾病中得益,但是,我很幸运,因为这种病没有像很可能发生的那样不利。”

I agree I have been very fortunate in everything except getting motor neurone disease. And even the disease has not been such a blow. With a lot of help, I have managed to get round the effects. I have the satisfaction in having succeeded in spite of it.

I'm really much happier than I was before it began. I can't say it has been a benefit, but I have been lucky that it has not been the disadvantage it could have been.



motor neurone disease 运动神经元症



Let's go back a bit . . .

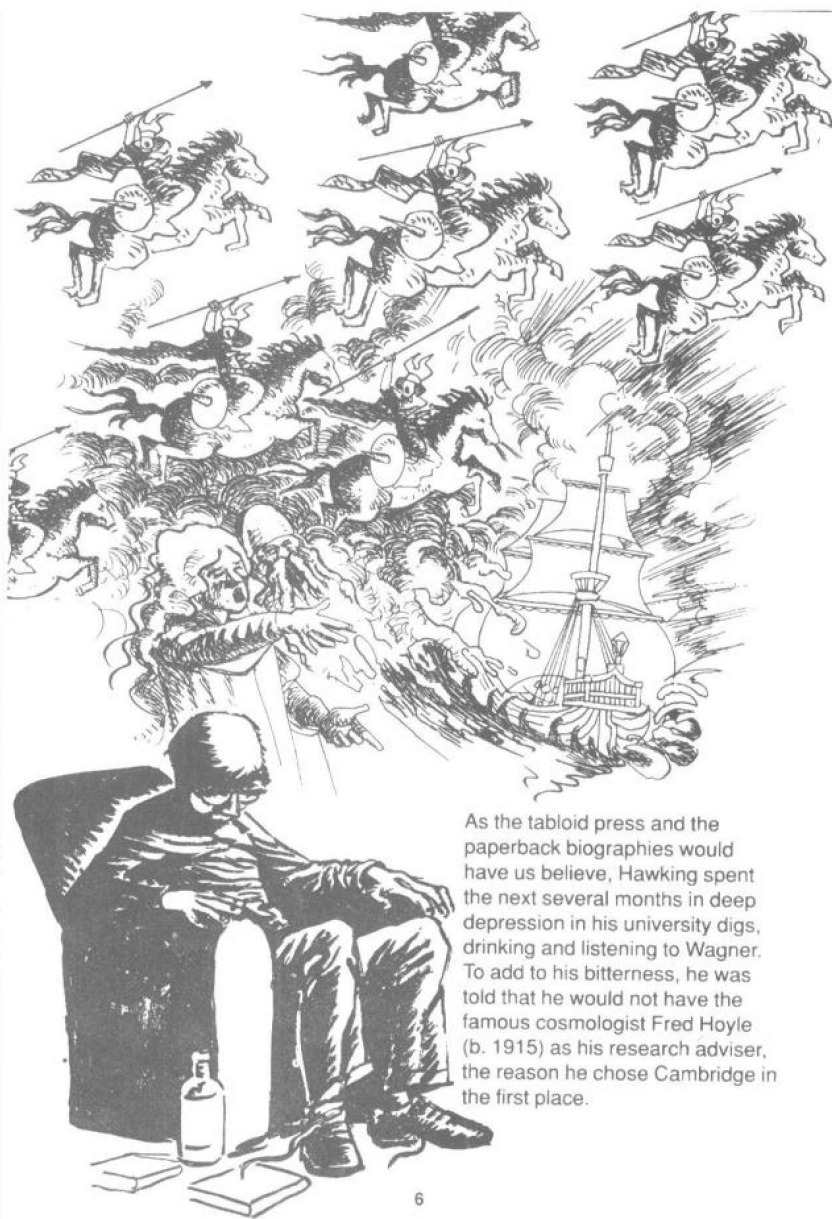
Everyone knows of Hawking's bad luck. It began one afternoon in the spring of 1962 when he found it very difficult to tie his shoelaces. He knew something was drastically wrong with his body. That year he had talked his way into a first degree at Oxford University and was accepted as a postgraduate student at Cambridge. But he had contracted **amyotrophic lateral sclerosis**, ALS for short, the ~~motor neurone~~ disease. It is incurable and fatal. Doctors gave him two years to live.

让我们回顾一下……

谁都知道霍金的不幸遭遇。1962年春天的一个下午，他忽然发现系鞋带很困难，知道身体出了大问题。那年，他凭着口才在牛津大学获得第一个学位，并被剑桥大学录取为研究生。但是他得了肌萎缩性侧索硬化症，简称ALS。这是一种运动神经细胞疾病，无法医治，而且会致人死命。医生说 he 只能再活两年。

amyotrophic lateral sclerosis 肌萎缩性侧索硬化症

就像我们从街头小报和平装本传记中了解到的那样，霍金在接下来的几个月中极为沮丧地待在学校宿舍里，整日喝酒，听瓦格纳的音乐。雪上加霜的是，他又被告知著名的宇宙学家弗雷德·霍伊尔（生于1915年）不会作他的研究导师，而这位导师正是他选择剑桥大学的原因。



As the tabloid press and the paperback biographies would have us believe, Hawking spent the next several months in deep depression in his university digs, drinking and listening to Wagner. To add to his bitterness, he was told that he would not have the famous cosmologist Fred Hoyle (b. 1915) as his research adviser, the reason he chose Cambridge in the first place.

tabloid *n.* 小型摘要报, 小报      paperback *a.* 平装的



But immediately his luck began to change. A young woman, Jane Wilde, he met on New Year's Eve 1962 had taken a genuine interest in him, and the Cambridge Physics Department had assigned him to Dennis Sciama (b. 1926), one of the best-informed and most inspiring research advisers in the world of relativistic cosmology.



Once it is accepted that Stephen William Hawking's physical capabilities were severely limited by the tragic disease of ALS, a whole series of fortunate events seemed to have taken place in the early 1960s which enabled him to fulfil his destiny as one of the leading cosmologists of modern times.

不过他的运气很快开始好转。他在 1962 年新年除夕之夜认识的一位名叫简·沃尔德的年轻姑娘对他产生了真情，剑桥大学物理系又安排他从师于丹尼斯·西艾玛（生于 1926 年）。丹尼斯·西艾玛是相对论性宇宙学界学识最渊博，最富有启发性的导师之一。

正当人们认为史蒂芬·霍金由于不幸身患肌萎缩性侧索硬化症而使身体活动能力受到严重限制时，60 年代初似乎发生了一连串幸运事件，使他得以完成当代最主要的宇宙学家之一的使命。

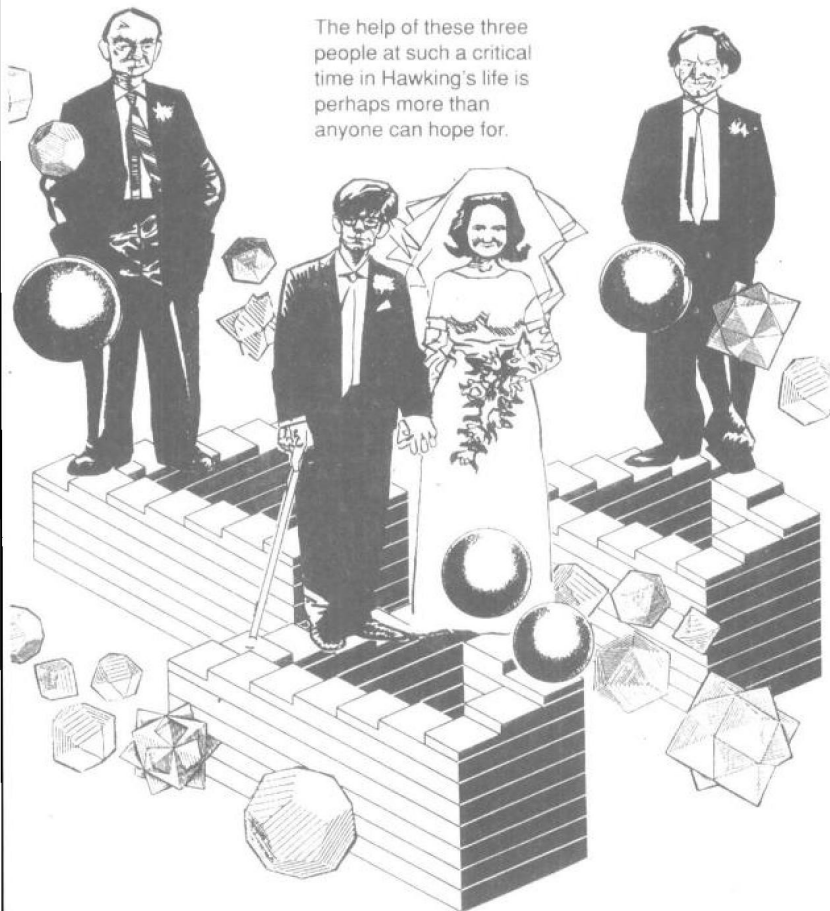
首先,在专业上,他选了理论物理,学习这种专业他仅需要的惟一工具就是大脑,而他的疾病并没有一丝一毫地损坏他的大脑。同时他遇到了简·沃尔德这个善于帮助的伴侣,并得到了西艾玛这个有同情心的论文导师。

不久他又遇到了研究黑洞问题的杰出的数学家罗杰·潘罗斯(生于1931年)。潘罗斯教他使用物理学中崭新的分析工具。潘罗斯还帮他解决了一个研究问题。这不仅拯救了他的博士论文,而且将他直接带入理论物理的主流。

在霍金生命中的关键时刻这三个人所提供的帮助可能超出了任何人的期望。

First of all, for the profession he had chosen – theoretical physics – the only facility he **absolutely** needed was his brain, which was completely unaffected by his illness. He had met a helpful partner in Jane Wilde and been presented with a sympathetic thesis adviser, Sciama.

Soon he would meet Roger Penrose (b. 1931), a brilliant mathematician working on black holes, who would teach him radically new analytical tools in physics. Penrose would help him solve a research problem that would not only save his doctoral dissertation but also bring him directly into mainstream theoretical physics.



doctoral dissertation 博士论文



He had another appointment with destiny at about the same time. A theory which had been developed almost fifty years earlier – Einstein's general theory of relativity – was only just being widely applied to practical problems in cosmology. It seems that predictions based on this theory were so bizarre that it had taken decades for it to be accepted. Now in the early 1960s, a golden age of research in cosmology based on general relativity was about to begin. Fate had waited for Stephen Hawking. The secretly ambitious – though by then slightly crippled – theoretical physicist was ready. He didn't know how long he had to live ... but he was certainly in the right place at the right time.



几乎在同一时期，霍金再度受到命运的垂青。一种近五十年前提出的理论——爱因斯坦的广义相对论——当时开始广泛地应用于研究宇宙学的实际问题。好像以这种理论为基础的预测太希奇古怪，要在几十年之后才能被接受。60年代初，一个以广义相对论为基础研究宇宙的黄金时代即将开始。命运在等待着霍金。这个内心充满抱负的理论物理学家——尽管那时已有些残废——已作好了一切准备。虽然他不知道还能活多久……但他显然拥有天时地利。

“可能他真的幸运。”

史蒂芬·霍金被称做相对论宇宙学家，就是说他主要应用相对论原理(相对论性的)研究整个宇宙(宇宙学)。

霍金的整个学术生涯——从 60 年代初到 90 年代中——都在研究理论物理，同爱因斯坦的广义相对论打交道，所以，了解一下什么是相对论或许是个好主意。

Stephen Hawking is called a **relativistic cosmologist**. This means he studies the Universe as a whole (cosmologist) and uses mainly the theory of relativity (relativistic).

As Hawking has spent his entire career as a theoretical physicist – from the early 1960s to the mid 1990s – working with Einstein's general relativity, it might be a good idea to know what it's about.

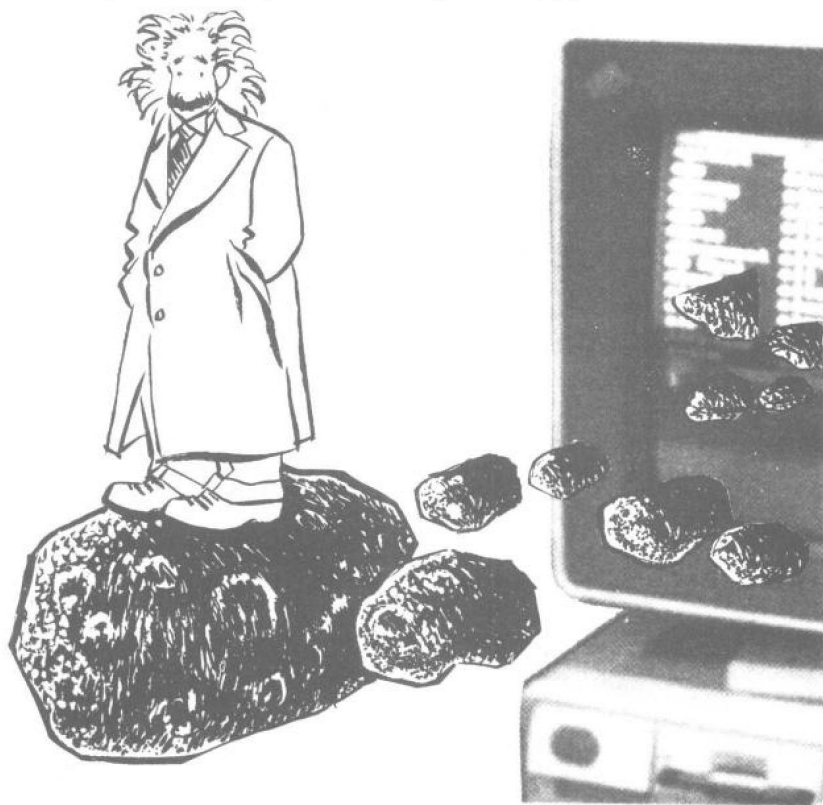


## The General Theory of Relativity

Berlin, November 1915. Albert Einstein (1879-1955) had just completed his theory of general relativity, a mathematical structure in which curved space and warped time are used to describe gravitation. All modern cosmology began two years later, when Einstein published a second paper called **Cosmological Considerations** in which he applied his new theory to the entire Universe.

General relativity is difficult to master, but the relatively few people who understand the theory agree it is an elegant, even beautiful theory of gravitation.

Describing a set of equations as beautiful doesn't help much in understanding how Einstein's theory differs from that of Isaac Newton (1642-1727). But an example of how each of the two theories describes gravity in the same physical situation might do the trick.



### 广义相对论

1915年11月，柏林。阿尔伯特·爱因斯坦（1879-1955）刚刚完成了他的广义相对论，即用弯曲的空间和扭曲的时间来描述引力的数学结构。现代宇宙学的兴起肇始于两年后，当时爱因斯坦发表了第二篇论文，题为《广义相对论的宇宙考察》。在这篇论文中，他将自己的新理论应用到整个宇宙。

广义相对论很难领会，但极少数理解它的人认为这是个优雅的、甚至美妙的引力理论。

说一组方程式美妙无助于我们理解爱因斯坦的理论和艾萨克·牛顿（1642-1727）的理论之间的差异。不过，举例说明这两个理论如何描述同一物理环境下的引力也许会有帮助。



## 为什么宇宙学家必须研究引力？

宇宙学是研究整个宇宙的学科，它在很大程度上立足于笼统的假设。引力决定了宇宙的大致结构，简单点说，引力将行星、恒星和星系维系在一起。这是宇宙学最重要的概念。

直到不久以前，宇宙学还被认作是伪科学，是留给那些光荣退休的教授们研究的学科。可是在过去的30年中，差不多就是霍金的学术生涯时期，两项重大的进展，使得这一学科发生了巨大的变化。

Why does a cosmologist have to study gravitation?

Cosmology is the study of the whole Universe and much of the subject is based on wide-sweeping hypotheses. Gravitation determines the large-scale structure of the Universe or, more simply, keeps the planets, star and galaxies together. It is the most important concept for work in this field.

Until recently, the subject of cosmology was considered to be a pseudo-science reserved for retired emeritus professors. But in the last three decades, more or less coinciding with Hawking's career, two major developments have changed the subject dramatically.



■ First, major breakthroughs in observational astronomy – reaching out to the most distant galaxies – have made the Universe a laboratory to test cosmological models.

■ Second, Einstein's general relativity has been proven over and over again to be an accurate and reliable theory of gravitation throughout the entire Universe.

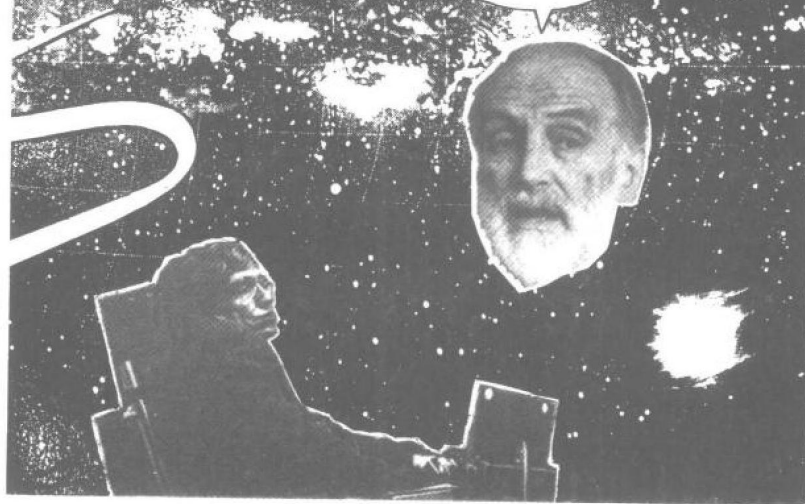
Remember, physics is a cumulative subject. New theories are built on previous ones, keeping the ideas that stand up to experimental test and discarding those that don't. Our final goal is to understand the contributions of Stephen Hawking who has taken Einstein's gravitation theory to its ultimate limit.

It is important to understand the notion of *partial theories*. For example, Newton's Law of Gravitation is very accurate only when gravity is weak – and must be replaced by Einstein's general relativity in strong gravitational fields. Similarly, relativity must be replaced by quantum mechanics when examining interactions on a microscopic scale, such as the big bang singularity, or at the edge and centre of a black hole.

Hawking is generally recognized as the theoretician with the best chance of combining general relativity and quantum mechanics to produce quantum gravity, ill-named by the media as **The Theory of Everything**.

THE COMPLETE STORY TAKES IN NEWTON, THEN EINSTEIN, THEN HAWKING.

FIRST, NEWTON.



■ 首先,观测天文学——取得了重大突破——能观测到最遥远的星系,使宇宙成了测试各种宇宙学模型的实验室。

■ 其次,爱因斯坦的广义相对论被一次又一次地证明是研究整个宇宙引力的精确可靠的理论。

记住,物理学是一门累积的学科。新的理论是建立在旧理论之上的,保留了经得住实验考验的概念,摒弃了经不住实验考验的东西。我们的最终目的是要了解将爱因斯坦的引力理论发挥到极限的史蒂芬·霍金的贡献。

弄明白部分有效的理论的涵义也是很重要的。例如,牛顿的万有引力定律只有在引力弱时才是精确的,在有强引力场的时候,它必被爱因斯坦的广义相对论所取代。同样,在观察显微规模上的相互作用时,如发生在大爆炸的奇点或黑洞的边缘和中心上的相互作用,相对论又必被量子力学所取代。霍金是公认的最有可能把广义相对论和量子力学结合起来创立量子引力论的理论家。媒介不恰当地把这种理论称为“万物之理”。

“整个故事包括牛顿、爱因斯坦、霍金。首先是牛顿。”

astronomy *n.* 天文学    cumulative *a.* 累积的    quantum mechanics 量子力学    gravitational field 万有引力场,重力场    microscopic scale 显微规模

### 牛顿:力的概念

牛顿引入了万有引力的概念,并说明两个物体之间互相吸引的力与每个物体的质量成正比(即物体所含的物质质量),与它们之间的距离的平方成反比。

$$F = \frac{G M_1 M_2}{R^2}$$

G:引力常数

$M_1 M_2$ : 两个物体的质量

$R^2$ : 物体质量之间的距离

“别着急,这是个非常简单的问题!”

我把它称做万有引力定律。

如果两个物体中的一个或另一个的质量增加一倍,引力也增加一倍;可是如果两个物体间的距离增加一倍,引力将减为原有的1/4,因为分母上有平方。

所以,两个物体的间距加大,它们之间的引力就会迅速减小。”

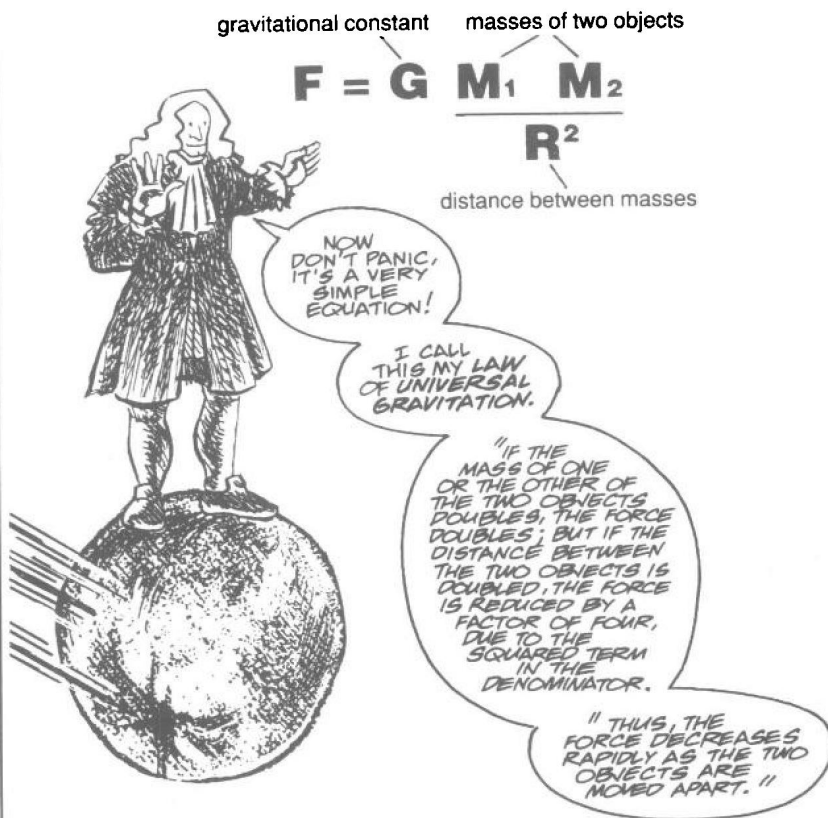
引力是自然界最弱的力,这从引力常数 G 在实用单位中的大小便可看出:

引力常数 =  $6.67 \times 10^{-11}$  牛顿米(公尺)<sup>2</sup>/(公斤)<sup>2</sup>

牛顿是力的科学单位,大致相当于 1/4 磅。

## Newton: The Concept of Force

Newton introduced the concept of a gravitational *force* of attraction and stated that the mutual pull of attraction between two objects is proportional to the **mass** of each object (i.e. the amount of matter the object contains) and inversely proportional to the square of distance between them.



Gravitation is the weakest force in nature as seen by the magnitude of the gravitational constant G in practical units:

$$G = 6.67 \times 10^{-11} \text{ Newtons-metres}^2 / \text{kilograms}^2$$

A Newton is a scientific unit of force, equal to about a quarter of a pound.

panic a. 恐慌的 denominator n. 分母

## Four Kinds of Force in the Universe

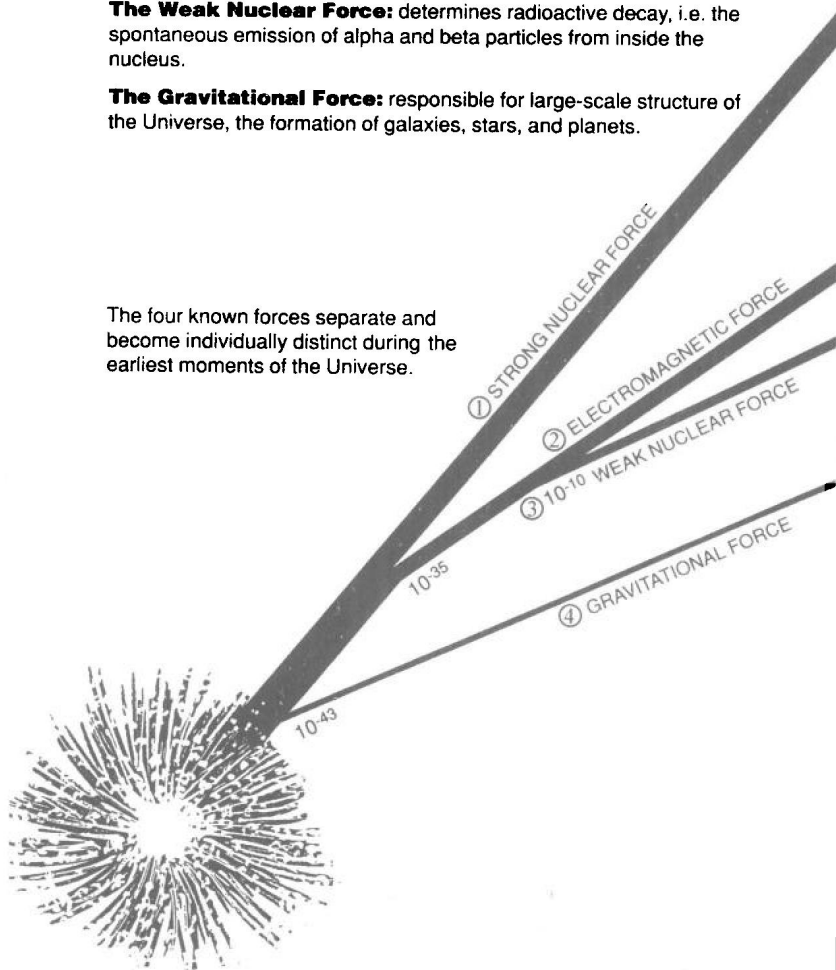
**The Electromagnetic Force:** keeps atoms together and is the basis for all chemical reactions.

**The Strong Nuclear Force:** binds the neutrons and protons together in the nucleus. This force is important in nuclear reactions like fission and fusion.

**The Weak Nuclear Force:** determines radioactive decay, i.e. the spontaneous emission of alpha and beta particles from inside the nucleus.

**The Gravitational Force:** responsible for large-scale structure of the Universe, the formation of galaxies, stars, and planets.

The four known forces separate and become individually distinct during the earliest moments of the Universe.



### 宇宙中的四种力

电磁力：将原子维系在一起的力，是一切化学反应的基础。

强核力：在原子核中将中子和质子束缚在一起的力，这种力在诸如核裂变和核聚变的核反应中起重要作用。

弱核力：决定放射性衰变，即从原子核内部自发放射出 $\alpha$ 和 $\beta$ 粒子。

引力：形成宇宙的大型结构，形成星系、恒星、行星。

这四种已知的力在宇宙形成的最初时期就已互相分离，并呈现出明显的差别。

- ① 强核力
- ② 电磁力
- ③ 弱核力
- ④ 引力

electromagnetic *n.* 电磁的    fission *n.* (核) 裂变, (核) 分裂    fusion *n.* 核聚变    decay *n.* 数量、活动、或力量的减少 (如放射性物质的衰变)