- 最新引进版
- 当代权威美语
- 美国中学生必备
- 经典英汉对照助学读物

乐纳理科趣味英汉对照读物

# Principles of Modern Physics

## Relativity and Quantum Mechanics

# 走近相对论和量子力学

by Paul Fleisher

[美] 保罗·弗莱谢尔 著

苏 静 译

乐纳 LERNER 文化娱乐教育丛书

明天出版社

**图书在版编目**（CIP）**数据**

走近相对论和量子力学／[美] 弗莱谢尔 (Paul) 著；苏静译．—济南：明天出版社，2003.2
（乐纳理科趣味英汉对照读物）
ISBN 7-5332-4069-3

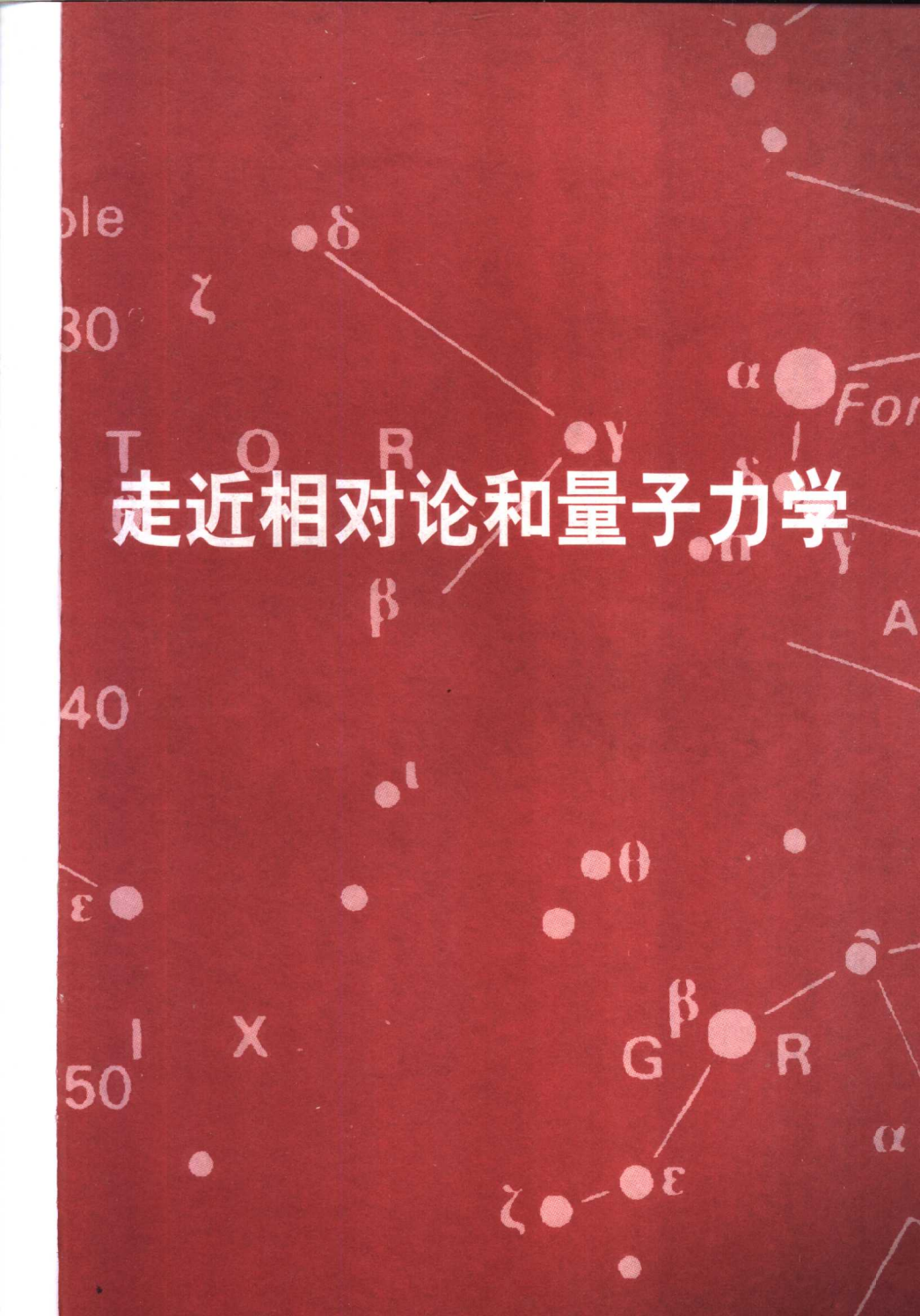
Ⅰ.走… Ⅱ.①弗… ②苏… Ⅲ.①英语－对照读物，相对论－英、汉②英语－对照读物，量子力学－英、汉 Ⅳ.H319.4：O

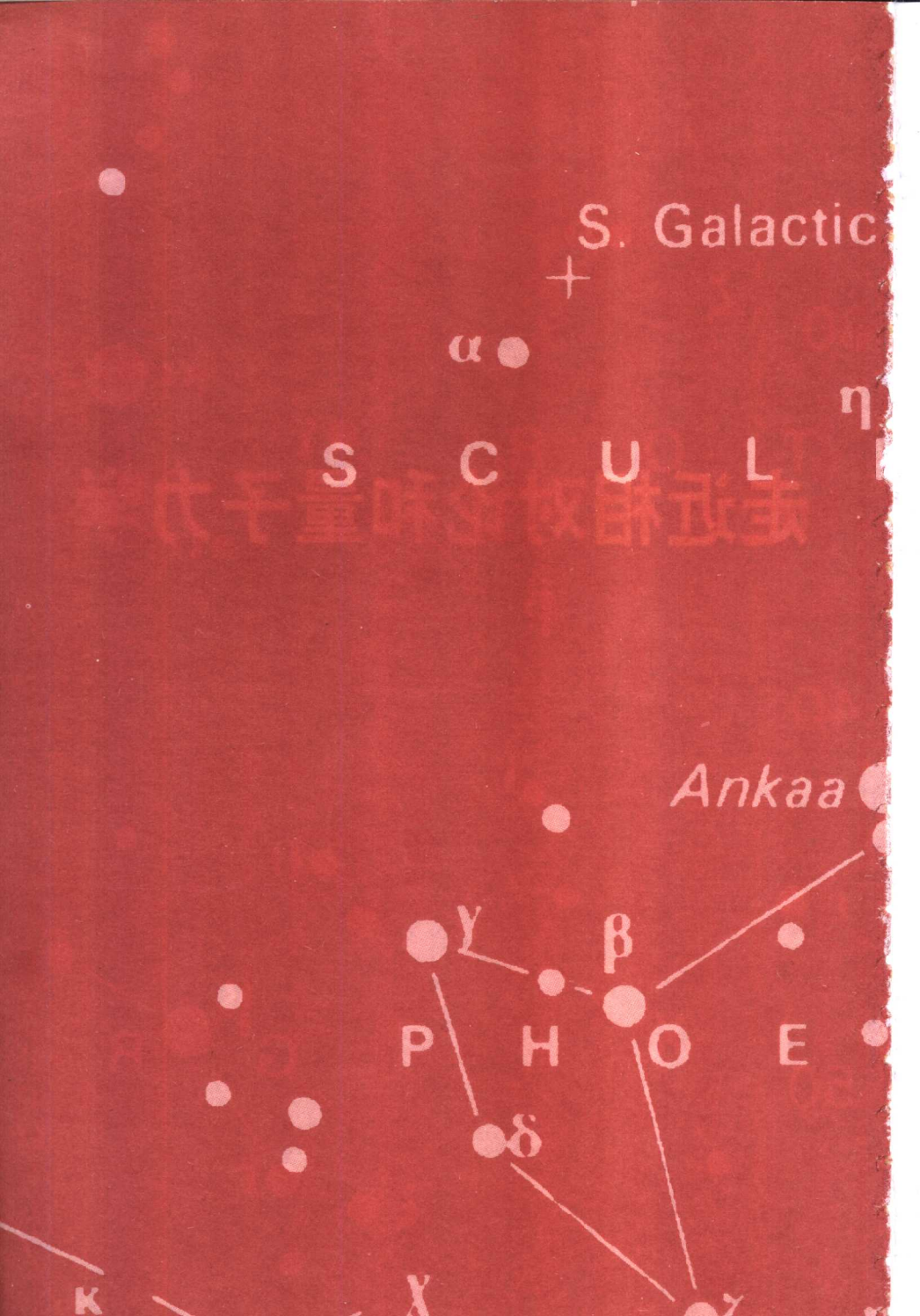
中国版本图书馆 CIP 数据核字（2002）第 108616 号

乐纳理科趣味英汉对照读物
**走近相对论和量子力学**
[美] 保罗·弗莱谢尔 著
苏 静 译
*
明天出版社出版
（济南经九路胜利大街 39 号）
http://www.sdpress.com.cn
http://www.tomorrowpub.com
山东省新华书店发行 山东新华印刷厂潍坊厂印刷
*
850×1168 毫米 32 开 3.375 印张
2003 年 2 月第 1 版 2003 年 2 月第 1 次印刷

ISBN 7-5332-4069-3
G·2198 定价：6.50 元

山东省著作权合同登记号：图字 15-2002-182


走近相对论和量子力学


S. Galactic
α
η
S C U L
Ankaa
γ
β
P H O E
δ
κ
χ

乐纳理科趣味英汉对照读物

# 走近相对论和量子力学

by Paul Fleisher
[美]保罗·弗莱谢尔 著
苏静 译

明天出版社

Original edition published in English under the title of
**Secrets of the Universe - Relativity and Quantum Mechanics**

Published by permission of Lerner Publications Company, a division of Lerner Publishing Group, 241 First Avenue North, Minneapolis, Minnesota 55401 U. S. A.

# Contents
# 目 录

# INTRODUCTION
# 引言

## What Is a Natural Law? 什么是自然定律？

Everyone knows what a law is. It's a rule that tells people what they must or must not do. Laws tell us that we shouldn't drive faster than the legal speed limit, that we must not take someone else's property, that we must pay taxes on our income each year.

人人所共知法律是一种准则，它告诉人们必须做什么或不得做什么。法律告诉我们开车不应超过法定的速度限制，不得拿别人的东西，必须每年缴纳所得税。

Where do these laws come from? In the United States and other democratic countries, laws are created by elected representatives. These men and women discuss which ideas they think would be fair and useful. Then they vote to decide which ones will actually become laws.

这些法律从何而来呢？在美国及其他民主国家，法律是由民众选举的代表制定的。这些男男女女讨论他们认为公平、有益的见解，然后他们投票决定哪些将真正成为法律。

---

legal *a.* 合法的，法律的
property *n.* 财产，资产，所有物
democratic *a.* 民主的
representative *n.* 代表



But there is another kind of law, a scientific law. You probably have heard about Albert Einstein's law of relativity, for example. Among other things, it tells us that nothing in our universe can go faster than the speed of light. Where did that law come from, and what could we do if we decided to change it?

The law of relativity is very different from a traffic speed limit or a law that says you must pay your taxes. Speed limits are different in different places. On many interstate highways drivers can travel 105 kilometers (65 miles) per hour. On crowded city streets they must drive more slowly. But relativity tells us that light travels at exactly the same speed no matter where it is or where it came from. In the country or the city, in France, Brazil, the United States, or even in interstellar space, light travels at 300,000 kilometers per second (186,000 miles per second).

但是还有另一种法——科学定律。比如，你也许听说过爱因斯坦的相对论定律。在我们宇宙里的其他事物中，没有任何事物能比光速更快。这条定律从何而来呢？如果我们想改变它，我们该怎么办呢？

相对论与限速法规或要求你必须缴纳税款的法律截然不同。速度限制因地而异：在许多州际公路上，驾驶者的时速可达105千米（65英里）；在拥挤的城市街道上，他们则必须要开得慢得多。然而，相对论告诉我们无论光处于何地，也无论它来自何方，其传播速度是一模一样的。无论是在农村还是在城市，也无论是在法国、巴西还是在美国，甚至是在星际空间，光的传播速度都是每秒30万千米（即每秒18.6万英里）。

interstellar *a.* 【天】星际的

Sometimes people break laws. When the speed limit is 88 kph (55 mph), people often drive 97 kph (60 mph) or even faster. But what happens when you try to break the law of relativity? You can't. Here on Earth, if you accurately measure the speed of light a thousand times, it will always travel at the same rate. It will never be faster or slower.

The law of relativity doesn't apply just when people are around, either. We know that the law stays in effect whether people are watching or not. The law of relativity is a natural law, or a rule of nature. Scientists and philosophers have studied events in our world for a long time. They have made careful observations and done many experiments. And they have found that certain events happen over and over again in a regular, predictable way. You have probably noticed some of these patterns in our world yourself.

人们有时会犯法。当速度限制为每小时88千米(即每小时55英里)时，人们往往会开到每小时97千米（即每小时60英里）甚至更快。可是当你试图违反相对论的定律时会出现什么情况呢？你无法做到这一点。在地球上，如果你精确地测量光速1000次，其传播速度始终相同。它永远都不会变快或变慢。

相对论的定律也不仅仅当有人在场时才适用。我们知道无论是否有人在注意，定律都会起作用。相对论是一种自然定律或自然界的一种法则。科学家和哲学家很久以来就在研究我们这个世界上所发生的种种事件。他们进行了仔细的观察，做了大量的实验。他们已发现某些事件以一种有规律的、可以预见的方式反复发生。也许你自己也已注意到了在这个世界上存在的这样的某些方式。

---

accurately *ad.* 精确地，准确地
predictable *a.* 可预言的，可预测的

A scientific law is a statement that tells how things work in the universe. It describes the way things are, not the way we want them to be. That means a scientific law is not something that can be changed whenever we choose. We can change the speed limit or the tax rate if we think they're too high or too low. But no matter how much we want to make light go faster or slower, its speed remains the same. We cannot change it; we can only describe it. A scientist's job is to describe the laws of nature as accurately and exactly as possible.

科学定律是对宇宙中事物的运行方式的说明。它描述的是事物自身存在的方式，而非我们希望它们存在的方式。这就意味着科学定律不是我们可以任意更改的东西。假如我们认为限速或税率过高或过低，那么我们可以将其改变。但无论我们多么希望光速能变快或变慢，它还是会保持不变。我们无法改变光速，我们只能对它加以描述。科学家的工作就是尽可能精准和确切地描述自然定律。

The laws you will read about in this book are universal laws. That means they are true not only here on Earth, but elsewhere throughout the universe too. The universe includes everything we know to exist: our planet, our solar system, our galaxy, all the other billions of stars and galaxies, and all the vast empty space

您即将在本书中读到的定律都是通用定律。这就意味着它们不仅在地球上是对的，而且在宇宙的其他地方也是对的。宇宙包括我们所知的现存的一切事物：我们的星球、我们的太阳系、我们的银河系、所有其他数十亿颗恒星和星系以及它们之间浩瀚虚无的太空。科学家们所收集到的

universal *a.* 普遍的，一般的
solar *a.* 太阳的
galaxy *n.* 银河系

in between. All the evidence that scientists have gathered about the other planets and stars in our universe tells us that the scientific laws that apply here on Earth also apply everywhere else.

宇宙中有关其他行星和恒星的所有证据都表明适用于地球的科学定律也同样适用于其他任何地方。

In the history of science, some laws have been found through the brilliant discoveries of a single person. The law of relativity, for example, is the result of Albert Einstein's great flash of individual understanding. But ordinarily, scientific laws are discovered through the efforts of many scientists, each one building on what others did earlier. When one scientist receives credit for discovering a law, it's important to remember that many other people also contributed to that discovery. Even Einstein's discovery was based on problems and questions that many other scientists had been working on for years.

在科学史上，有些定律是通过个人了不起的发现而建立起来的。例如，相对论定律是源于阿尔伯特·爱因斯坦个人智慧的灵光闪现。然而一般说来，科学定律是通过许多科学家的共同努力发现的，而每位科学家的发现又是建立在其前辈所做贡献的基础之上的。当一位科学家因为发现一项定律而受到赞誉时，重要的是不要忘记还有许多人也对这一发现做出了贡献。甚至爱因斯坦的发现也是建立在其他许多科学家多年来一直致力研究的问题和课题的基础之上的。

Scientific laws do change, on rare occasions. They don't change because

在极少数情况下，科学定律会有所改变。它们并非由于我们

apply *v.* 适用
individual *a.* 个人的

we tell the universe to behave differently. Scientific laws change only if we have new information or more accurate observations. The law changes when scientists make new discoveries that show the old law doesn't describe the universe as well as it should. Whenever scientists agree to a change in the laws of nature, the new law describes events more completely, or more simply and clearly.

告诉宇宙要以不同的方式运转而改变。只有当我们掌握了新的信息或做出更为准确的观察时，科学定律才会发生变化。当科学家们有了新的发现，表明旧的定律不像人们所期待的那样能很好地描述宇宙时，定律就会改变。每当科学家们一致认为自然定律有所改变时，新的定律便能更加全面、简洁、清楚地描述事件。

Relativity is good example of this. In the 1900s, scientists had believed that they should be able to measure differences in the speed of light, depending on whether the light source-a star for example-was moving rapidly toward us or away from us. They kept trying more and more accurate experiments. But better measurements still didn't show any difference. The speed of light always measured the same 300,000 kilometers per second. Einstein finally realized that there was nothing wrong with the experiments. Instead, the

关于这一点，相对论是个很好的例子。在20世纪，科学家们曾经相信他们应该能够测出不同的光速，这要取决于光源——比如恒星——是在迅速靠近我们还是在远离我们。他们一直尝试进行愈来愈精确的实验。然而，更精确的测量结果并未显示光速有任何不同。所测得的光速始终是每秒30万千米。爱因斯坦最终意识到实验本身并无错误。相反，无论在何时何地测量，光速始终相同。这一思想意味着科学家们不得不以一种与日常经验迥然不同的全新方式来看待宇宙的许多

speed of light was always the same no matter where or when it was measured. This idea meant that scientists had to look at many of the laws of the universe in a completely new way that seemed very different from everyday experience.

定律。

Natural laws are often written in the language of mathematics. This allows scientists to be more exact in their descriptions of how things work. For example, you've probably heard of Einstein's equation $E = mc^2$.

自然定律往往以数学的语言来书写。这使得科学家们得以更加精确地描述事物的运行方式。例如，你大概听说过爱因斯坦的方程式 $E=mc^2$。

It's one of the most famous equations in science. But don't let the math fool you. It's simply a mathematical way of saying that mass ($m$), or matter, can be changed into energy ($E$). Writing it this way lets scientists compute the amount of energy contained in a certain amount of matter.

它是最著名的科学方程式之一。但是你不要被数学愚弄了，它只不过是用数学的方式来说明质量($m$)或物质可以被转化成能量 ($E$)。以这种方式书写的方程式可以让科学家们计算出一定质量的物质包含多少能量。

The science of matter and energy and how they behave is called physics. In the hundreds of years that physicists have been studying our universe,

物质与能量及其作用方式的科学被称做物理学。几百年来，物理学家一直在研究我们宇宙并发现了许多自然定律。在本书

exact *a.* 精确的，准确的，确切的
equation *n.* 【数】等式，方程式
mass *n.* 【物】质量
compute *v.* 计算

they have discovered many natural laws. In this book, you'll read about several of these great discoveries. There will be some simple experiments you can do to see the laws in action. Read on, and share the fascinating stories of the laws that reveal the secrets of our universe.

中，你将读到几项这样的重大发现。你可以做几个简单的实验看看定律所起的作用。继续读下去，来分享那些揭示了宇宙奥秘的定律的精彩故事吧。

---

fascinating *a.* 迷人的，有极大吸引力的

# CHAPTER 1
# 第 1 章

## Relativity

Picture yourself riding down the road in your family's car. The speedometer says that you are traveling 80 kilometers (50 miles) per hour. But how fast are you really going? If you look out the window, you'll see the countryside moving past you at 80 kilometers per hour. But if you look at the person sitting next to you in the car, it looks as if he or she isn't moving at all. You're both sitting perfectly still. Are you really moving or not?

If you think about the situation further, it gets even more puzzling. Your car is traveling on the surface of

## 相对论

想像一下你正开着自家的车行驶在路上。速度计显示你正以每小时 80 千米（50 英里）的速度前进。但是你的实际速度有多快呢？如果往窗外看去，你会发现乡村正以每小时 80 千米的速度从你身边掠过，可如果看看车内坐在你身边的人，你会觉得他（或她）似乎根本就没动。你们两人都坐着一动不动。你到底是真的在运动，还是没有运动呢？

假如再进一步地考虑这个问题，情况甚至会变得更加令人费解。你的车正行驶在地球表面，

speedometer *n.* (尤指汽车的)速度计，里程计　　puzzling *a.* 令人迷惑的

Earth. Earth is rotating on its axis at about 1,700 kilometers (1,000 miles) per hour, and so is everything on it. Perhaps you are really moving that fast.

But wait. Earth is traveling around the Sun at a speed of 30 kilometers (about 20 miles) per second. And the solar system is moving through our galaxy at a speed of about 240 kilometers (150 miles) per second. Which is the correct speed for your car? The answer is: It depends on what you're comparing your speed to. You can't measure speed unless you choose something to measure it against. Your car's speedometer measures your speed by comparing it to the road, which it considers to be standing still.

Suppose you toss a ball up and down as you sit in your car riding down the road. You would see the ball going straight up and down. But someone standing by the roadside

而地球自转的速度为每小时1700千米(1000英里),地球上所有的一切也是如此。也许你真的是以那么快的速度在运动。

不过且慢,地球以每秒30千米(约20英里)的速度绕太阳旋转,而太阳系则以每秒大约240千米(150英里)的速度在银河系中运动,哪一个才是你车子的正确速度呢?答案是:这取决于你拿什么与你的车速进行比较。你必须得先选定速度的参照物,然后才能测出速度。你的汽车的速度计测得的速度是相对于它认为是静止不动的道路而言的。

试想当你坐在行驶在公路上的汽车里时,你将一个球上下抛动。你会看到球上下作直线运动。但是站在路边的人看到的会是完全不同的景象,他(或她)会

rotate *v.* 旋转,转动
axis *n.* 轴,轴线
compare *v.* 比较
suppose *v.* 假设,猜想