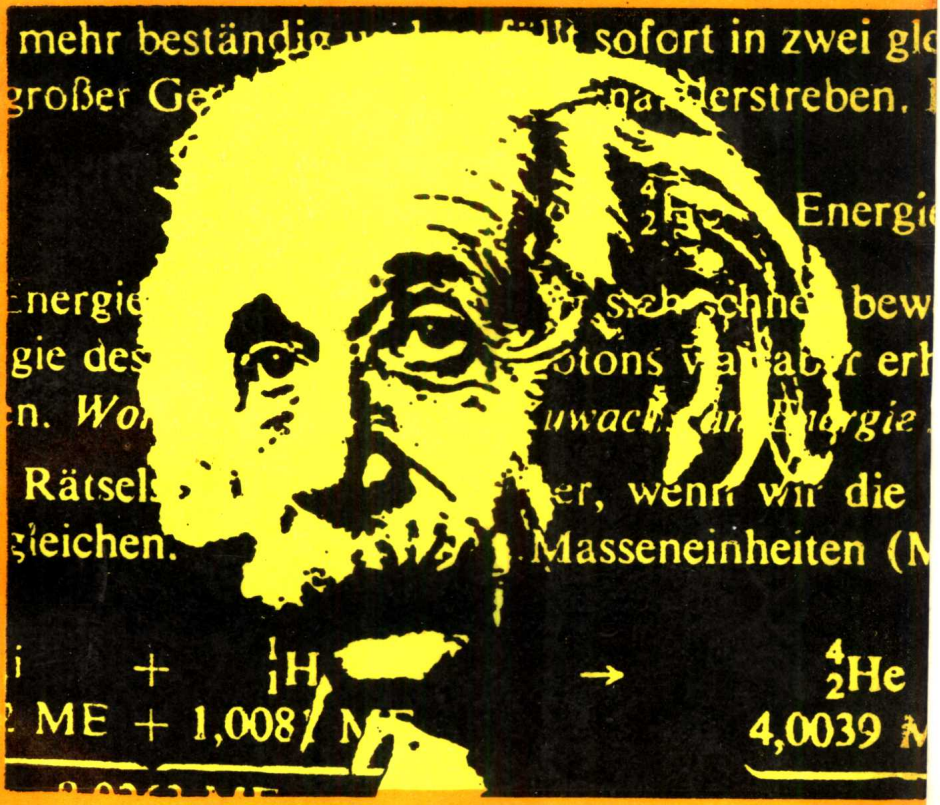
英汉对照物理学读物



物理学与物理学家

杨建邺等 译 苏文芳 校

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杨建邺 等译

苏文方 校

华中工学院出版社

内 容 简 介

本书介绍了一些物理学发展过程中的重大事件，这些事件的发生加速了物理学的发展进程，例如电磁场概念的提出、建立，放射性的发现，宇称守恒定律的被否定等等。本书的精采之处还在于，所选的大部分文章出于大师之手，是作出伟大发现的物理学家们亲身的回忆，如查德威克谈中子的发现，以及乌仑贝克对电子自旋概念提出过程的回忆等等。读者将从这些文章中领悟到科学哲学等方面深刻的启示。

本书以英汉对照的形式展现上述内容，不仅为广大物理专业的师生、科技人员、科学史工作者提供了丰富可靠的史料，而且为众多英语爱好者提供了参考读物。

英汉对照物理学读物
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杨建邺 等译
责任编辑 焦薇
华中工学院出版社出版发行
（武昌喻家山）
新华书店湖北发行所经销
武汉大学出版社印刷总厂印刷
开本：850×1168 1/32 印张：10.125 字数：101 000
1987年11月第1版 1987年11月第1次印刷
印数：1—1 200
ISBN 7-5609-0062-3/H·14
统一书号：13255—069 定价：2.40元

译者的话

当您翻开这本不厚的书时，您将会读到介绍有关下述内容的一些文章：

法国物理学家约里奥-居理夫妇在实验中发现了一种穿透力特别强的射线，他们对此感到迷惑不解。由于一种错误的认识，他们最初认为这种射线是γ射线。但消息一传到海峡对岸的英国物理学家查德威克那儿时，他却立即意识到，被约里奥-居理夫妇称为γ射线的东西，实际上是他寻找了十几年的中子。查德威克因此荣获1935年的诺贝尔物理学奖。按理说查德威克应该心满意足了吧！但他在回忆中却说，他经历了一种内心的折磨……。

1925年前后，正当以机智蜚声欧洲物理学界的泡利，为不相容原理的有关问题苦苦思索而不得其解的时候，有两个荷兰的大学生却出乎人们预料之外地提出了一个成功的模型——电子自旋！如果我们知道，当时已经很有名气的泡利曾反对过这一模型，而提出自旋模型之一的高斯密特竟连力学中的自由度都还不清楚，我们也许会惊诧莫名。

还有，当全世界物理学家普遍把宇称守恒作为金科玉律的时候，两位当时年仅三十岁左右的华裔物理学家杨振宁和李政道却大胆地否定了这个规律；更有甚者，当需要用实验证明这一大胆得近乎疯狂的结论时，竟没有人敢于做这个实验，谁不害怕把一生的时间都搭进去而毫无结果？这时，又是一位华裔物理学家吴健雄，她勇敢地接受了这一严峻的挑战！结果他们三人胜利了。当众多物理学家从这场震动中醒悟过来时，他们感到中国人有点不可思议，他们还为此发表了一些高见，解释为什么恰恰是三个中国人作出了这一划时代的发现……。

宋曾公亮曾在《宿甘露僧舍》一诗中说：

要看银山拍天浪，

开窗放入大江来。

读者如想领略科学家探索未知世界的一些激动人心的经历、感受，最好是请您翻开这本书仔细读一读，光靠《译者的话》是说不全的。只有当您读完了这本书，您才会深切地感到，展示在您面前的是激动人心的理智的奋斗，是令人肃然起敬的毅力的较量。

写到这儿，不由地使人想起了两件很值得一提的事情。1877年，当德国物理学家赫芝结束了一年的兵役，重返大学受教于当时著名的物理学家菲利浦·冯·约里（约里也是普朗克的老师）之时，约里首先建议赫芝研究拉格朗日、拉普拉斯等经典作家的著作，并要他注意自然科学发展的历史。约里认为这样有助于理解自然科学的迫切问题。赫芝以认真的态度接受了老师的建议，仔细研究了大量科学史著作。不仅如此，他还经常去听历史课。这些对科学史以及历史的研究，无疑对他日后的巨大成功起了不小的作用。另一位物理大师麦克斯韦，根据他自己的经验，常常告诫青年科学工作者，学习不能仅局限于某一专门的学科，若要深入地理解自然科学问题，应该研究哲学、美学和科学史。

正是由于此，我们愿意把这本书奉献给读者。读完本书之后，我们相信读者对物理学将会获得一种比较深入的了解，即从历史发展的、动态的角度来理解、把握物理学。这样就可以避免生吞活剥地接受物理知识，就不会把现有的物理知识看成是生来就十分完善、今后也不会发展的一种凝固、僵死的东西。显然，这对于激发青年人进行科学探索的热情是大有好处的，而了解和掌握杰出科学家各具代表性的思想方法，则更有利于提高青年人独立处理问题的能力。

本书选取的十五篇文章，除了G.E.乌仑贝克和S.A.高斯密特回忆自旋提出的两篇文章是选自《今日物理》（***Physic Today***）以外，其他十三篇文章均选自美国马里兰大学学生读物《物理世

界》（*A Universe of Physics*）一书。

参加本书翻译的有杨建邺、容敏丽、朱苍磬和杨镰，杨建邺还作了全书的统稿和注释工作。由于译者们都不是专攻英语和物理学史的，所以译文一定有不尽人意之处，错误亦在所难免，我们诚恳希望读者能提出批评。

本书在翻译过程中，承蒙华中师范大学物理系苏文芳副教授作了认真的校阅，在此向他表示由衷的感谢。

译者于华中工学院

一九八六年十月

目　录

1 *The Value of Science*

Richard P. Feynman

From time to time, people suggest to me that scientists ought to give more consideration to social problems—especially that they should be more responsible in considering the impact of science upon society. This same suggestion must be made to many other scientists, and it seems to be generally believed that if the scientists would only look at these very difficult social problems and not spend so much time fooling with the less vital scientific ones, great success would come of it.

It seems to me that we do think about these problems from time to time, but we don't put full-time effort into them—the reason being that we know we don't have any magic formula for solving problems, that social problems are very much harder than scientific ones, and that we usually don't get anywhere when we do think about them.

I believe that a scientist looking at nonscientific problems is just as dumb as the next guy—and when he talks about a nonscientific matter, he will sound as naive as anyone untrained in the matter. Since the question of the value of science is not a scientific subject, this discussion is dedicated to proving my point—by example.

The first way in which science is of value is familiar to everyone. It is that scientific knowledge enables

us to do all kinds of things and to make all kinds of things. Of course if we make good things, it is not only to the credit of science; it is also to the credit of the moral choice which led us to good work. Scientific knowledge is an enabling power to do either good or bad—but it does not carry instructions on how to use it. Such power has evident value—even though the power may be negated by what one does.

I learned a way of expressing this common human problem on a trip to Honolulu. In a Buddhist temple there, the man in charge explained a little bit about the Buddhist religion for tourists, and then ended his talk by telling them he had something to say to them that they would never forget—and I have never forgotten it. It was a proverb of the Buddhist religion,

"To every man is given the key to the gates of heaven; the same key opens the gates of hell."

What then, is the value of the key to heaven? It is true that if we lack clear instructions that determine which is the gate to heaven and which the gate to hell, the key may be a dangerous object to use, but it obviously has value. How can we enter heaven without it?

The instructions, also, would be of no value without the key. So it is evident that, in spite of the fact that science could produce enormous horror in the world, it is of value because it can produce something.

Another value of science is the fun called intellectual enjoyment which some people get from reading and

learning and thinking about it, and which others get from working in it. This is a very real and important point and one which is not considered enough by those who tell us it is our social responsibility to reflect on the impact of science on society.

Is this mere personal enjoyment of value to society as a whole? No! But it is also a responsibility to consider the value of society itself. Is it, in the last analysis, to arrange things so that people can enjoy things? If so, the enjoyment of science is as important as anything else.

But I would like not to underestimate the value of the world view which is the result of scientific effort. We have been led to imagine all sorts of things infinitely more marvelous than the imaginings of poets and dreamers of the past. It shows that the imagination of nature is far, far greater than the imagination of man. For instance, how much more remarkable it is for us all to be stuck—half of us upside down—by a mysterious attraction, to a spinning ball that has been swinging in space for billions of years, than to be carried on the back of an elephant supported on a tortoise swimming in a bottomless sea.

I have thought about these things so many times alone that I hope you will excuse me if I remind you of some thoughts that I am sure you have all had—or this type of thought—which no one could ever have had in the past, because people then didn't have the information we have about the world today.

For instance, I stand at the seashore, alone, and start to think. There are the rushing waves··· mountains of molecules, each stupidly minding its own business··· trillions apart···yet forming white surf in unison.

Ages on ages···before any eyes could see···year after year ··· thunderously pounding the shore as now. For whom, for what?···on a dead planet, with no life to entertain.

Never at rest···tortured by energy··· wasted prodigiously by the sun···poured into space. A mite makes thesea roar.

Deep in the sea, all molecules repeat the patterns of one another till complex new ones are formed. They make others like themselves···and a new dance starts.

Growing in size and complexity··· living things, masses of atoms, DNA, protein ··· dancing a pattern ever more intricate.

Out of the cradle onto the dry land···here it is standing ··· atoms with consciousness···matter with curiosity.

Stands at the sea···wonders at wondering···I···a universe of atoms···an atom in the universe.

THE GRAND ADVENTURE

The same thrill, the same awe and mystery, come again and again when we look at any problem deeply enough. With more knowledge comes deeper, more wonderful mystery, luring one on to penetrate deeper still. Never concerned that the answer may prove disappointing, but with pleasure and confidence we turn over

each new stone to find uninmagined strangeness leading on to more wonderful questions and mysteries—certainly a grand adventure!

It is true that few unscientific people have this particular type of religious experience. Our poets do not write about it; our artists do not try to portray this remarkable thing. I don't know why. Is nobody inspired by our present picture of the universe? The value of science remains unsung by singers, so you are reduced to hearing—not a song or a poem, but an evening lecture about it. This is not yet a scientific age.

Perhaps one of the reasons is that you have to know how to read the music. For instance, the scientific article says, perhaps, something like this: "The radioactive phosphorous content of the cerebrum of the rat decreases to one-half in a period of two weeks. "Now, what does that mean?

It means that phosphorus that is in the brain of a rat(and also in mine, and yours) is not the same phosphorus as it was two weeks ago, but that all of the atoms that are in the brain are being replaced, and the ones that were there before have gone away.

So what is this mind, what are these atoms with consciousness? Last week's potatoes! That is what now can remember what was going on in my mind a year ago —a mind which has long ago been replaced.

That is what it means when one discovers how long it takes for the atoms of the brain to be replaced by other atoms, to note that the thing which I call my in-

dividuality is only a pattern or dance. The atoms come into my brain, dance a dance, then go out; always new atoms but always doing the same dance, remembering what the dance was yesterday.

THE REMARKABLE IDEA

When we read about this in the newspaper, it says, "The scientist says that this discovery may have importance in the cure of cancer." The paper is only interested in the use of the idea, not the idea itself. Hardly anyone can understand the importance of an idea, it is so remarkable. Except that, possibly, some children catch on. And when a child catches on to an idea like that, we have a scientist. These ideas do filter down (in spite of all the conversation about TV replacing thinking), and lots of kids get the spirit—and when they have the spirit you have a scientist. It's too late for them to get the spirit when they are in our universities, so we must attempt to explain these ideas to children.

I would now like to turn to a third value that science has. It is a little more indirect, but not much. The scientist has a lot of experience with ignorance and doubt and uncertainty, and this experience is of very great importance, I think. When a scientist doesn't know the answer to a problem, he is ignorant. When he has a hunch as to what the result is, he is uncertain. And when he is pretty darn sure of what the result is going to be, he is in some doubt. We have found it of

paramount importance that in order to progress we must recognize the ignorance and leave room for doubt. Scientific knowledge is a body of statements of varying degrees of certainty—some most unsure, some nearly sure, none absolutely certain.

Now, we scientists are used to this, and we take it for granted that it is perfectly consistent to be unsure —that it is possible to live and not know. But I don't know whether everyone realizes that this is true. Our freedom to doubt was born of a struggle against authority in the early days of science. It was a very deep and strong struggle. Permit us to question—to doubt, that's all—not to be sure. And I think it is important that we do not forget the importance of this struggle and thus perhaps lose what we have gained. Here lies a responsibility to society.

We are all sad when we think of the wondrous potentialities human beings seem to have, as contrasted with their small accomplishments. Again and again people have thought that we could do much better. They of the past saw in the nightmare of their times a dream for the future. We, of their future, see that their dreams, in certain ways surpassed, have in many ways remained dreams. The hopes for the future today are, in good share, those of yesterday.

EDUCATION, FOR GOOD AND EVIL

Once some thought that the possibilities people had were not developed because most of those people were