世界优秀教材
中国版

理科类系列教材

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改编版

Physics for Scientists and Engineers with Modern Physics (Third Edition)

大学物理学（第3版）

□ Douglas C. Giancoli 原著
□ 滕小瑛 改编

高等教育出版社
Higher Education Press

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出版者的话

为适应当前我国高等学校各类创新人才培养的需要，大力推进教育部倡导的双语教学，配合教育部实施的“高等学校教学质量与教学改革工程”和“精品课程”建设的需要，国内一些出版社都陆续原版引进了不少海外优秀教材。海外优秀教材的立体化配套、多种教学资源的整合，以及为课程提供的整体教学解决方案，都有不少值得我们学习借鉴之处。但一个不容忽视的问题是，外文原版教材与我国现行的课程内容、教学体系、教学习惯等存在着巨大的差异性。譬如，重点课程的原版教材通常很厚，内容很多，容量是国内自编教材的好几倍。国外的情况是，老师未必会都讲，剩下大量的内容留给学生自学；而国内的情况不尽相同。受国内教学学时所限，完全照搬是不合时宜的。教材的国际化必须与本民族的文化教育传统相融合，在原有的基础上吸收国外优秀教材的长处，这使得我们需要对外文原版教材进行适当的改编。改编不是简单地使内容减少，而是结合国内教学特点，引进国外先进的教学模式及思想，在教学内容和方式上更中国化，使之更符合国内的课程设置及教学环境。

2004年伊始，高等教育出版社有计划、大规模地开展了海外优秀理科系列教材的引进及改编工作。在引进改编海外优秀教材的过程中，我们坚持了两条原则：（1）精选版本，打造精品系列；（2）慎选改编者，保证品质。

首先，我们和Pearson Education, John Wiley & Sons, McGraw-Hill以及Thomson Learning等国外出版公司进行了广泛接触，经推荐并在国内专家的协助下，提交引进版权总数200余种，学科专业领域涉及数学、物理、化学化工、地理、环境等。收到样书后，我们聘请了国内高校一线教师、专家学者参与这些原版教材的评介工作，从中遴选出了一批优秀教材进行改编，并组织出版。这批教材普遍具有以下特点：（1）基本上是近几年出版的，在国际上被广泛使用，在同类教材中具有相当的权威性；（2）高版次，历经多年教学实践检验，内容翔实准确，反映时代要求；（3）各种教学资源配套整齐，为师生提供了极大的便利；（4）插图精美，丰富，图文并茂，与正文相辅相成；（5）语言简练，流畅，可读性强，比较适合非英语国家的学生阅读。

其次，慎选改编者。原版教材确定后，随之碰到的问题是寻找合适的改编者。要改编一本教材，必须要从头到尾吃透它，有这样的精力自编一本教材都绰绰有余了。我们与国内众多高等院校的专家学者进行了广泛的接触和细致的协商，几经酝酿，最终确定下来改编者。大多数改编者都是有国外留学背景的中青年学者，他们既有相当高的学术水平，又热爱教学，长期工作在教学第一线。他们了解引进版教材的知识结构、表达方式和写作方法，最重要的是他们有时间，有精力，有热情，有的甚至付出了比写一本新教材更多的劳动。我们向他们表示最真诚的敬意。

在努力降低引进教材售价方面，高等教育出版社做了大量和细致的工作，这套引进改编的教材体现了一定的权威性、系统性、先进性和经济性等特点。

这套教材出版后，我们将结合各高校的双语教学计划，开展大规模的宣传和培训工作，及时地将本套丛书推荐给各高校使用。在使用过程中，我们衷心希望广大教师和学生提出宝贵的意见和建议。如有好的教材值得引进，也请与高等教育出版社高等理科分社联系。联系电话：010-58581384（数学）；010-58581374（物理）；010-58581380（化学化工）。E-mail: xuke@hep.com.cn。

高等教育出版社

2004年10月

前　言

2004年3月笔者接受高等教育出版社的合作邀请，改编D.C.Giancoli的Physics for Scientists and Engineers with Modern Physics, 3rd edition一书。

在二十多年的大学物理教学工作和三年多的双语教学实践中，笔者对国内外教材各自的优点和不足有了一定的认识和了解。国外优秀的物理教材不仅在语言上地道流畅，而且还附有大量的图片和事例，生动有趣，对新问题的引出和重大物理事件的叙述也引人入胜，具有提高学习兴趣，启迪学生思维的效果。此外，它们还有一个共同的显著特点，就是注重从人文的角度反映物理学的发展和现代物理学的进展，注重物理学与日常生活中的物理现象和现代科学技术中的应用相结合，物理理论与实践问题的联系和指导作用等方面的阐述也都非常贴切和精辟，尤其是现代物理部分更为精彩。

国外物理教材的不足在于，系统和结构上不如国内教材那样严谨，有些在内容归类和章节编排等方面也不如国内教材那样有序合理。在理论深度上也较为欠缺，如经典部分中高等数学的应用较少，电磁学中介质内容的讨论也不够全面。

不过，论及在双语教学中，直接引用国外优秀教材，将其优点充分展示给我们的学生，相比其结构上的不紧凑和难易程度的不吻合，优越之处还是远远胜过这些不足的。而且这些不足也可通过教师的讲授加以弥补。而其中所带来的最大问题还应属与国内学生在中学阶段所学相重叠的那部分内容，这部分内容在中学阶段已完成，不属于“大学物理教学基本要求”的范围（如静平衡、几何光学等），但它们在国外教材中占了相当大的篇幅，这就加重了使用者尤其是经济困难学生的负担，很不利于这些优秀资源在国内的推广使用。

笔者在近几年从事大学物理双语教学工作中，一直盼望能有机会将中西精华合璧，尽可能融合各家所长，弥补不足，整理出一套适应我国高等教育改革，满足双语教学需求的教材。现在终能有这么一个机会，将上述想法、渴望变为现实，真是发自内心的高兴。

为将这部优秀教材改为适我所用，为优秀资源本土化的尝试工作打下良好开端，笔者自接受这项工作后，一方面细读原著，仔细体会作者的想法、写作特点，一方面与具有丰富教学经验的同行交流修改方案，与出版社的同志反复沟通，从他们那里了解最新的来自全国各层次学校的不同需求，再结合多年教学中摸索出的经验、体会及双语教学中的切身感悟，反复推敲，几经易稿，最终确定了改编方案。在改编中遵循的基本原则是：

（1）在不破坏原著风格的基础上，力求符合我国“大学物理教学基本要求”。

（2）对有些我国学生在中学阶段学过的内容，如所占篇幅不大，删去后却会影响前后衔接的，予以保留。例如，原著中质点的运动学和动力学部分，除删掉些不很重要的、简单的例题外，并未做大改动。我们认为这样既可保证内容的顺畅连贯，又有助于学生尽快地适应双语教学。

（3）兼顾教材使用的受众面，尽可能适应国内理工科各专业的需求，满足不同层次学校学生的需要。

（4）原著中有些内容虽不属于“大学物理教学基本要求”，但写得非常精彩，且有益于拓展学生视野，了解物理学发展，可给教师以选择余地，改编中加“*”号以示与必学内容区别而作为阅读内容保留，与原内容所配的不重要的例题和小结、思考题、习题等予以删除。

（5）在以上大原则基础上，力求精简篇幅，提高版面的利用率，降低成本，使国内学生能够接受。

由于改编只能在原著基础上进行，有些方面实感难以尽如人意，例如，影响原著前后连贯一致的一些内容，有些即使细、简，显得有些啰嗦，也得保留；有些是我们大纲的重点要求，但原著中却没有，也无法加入。对此笔者与出版社也想到一个弥补方法，即研制与教材配套的电子教案，在其中体现这些改进想法，从而利用现代教学手段更好地补充和弥合国外教材与国内教学实际情况的差别。相信对使用国外教材，不时会感到某种“不顺手”的授课教师一定会喜欢这种弥补方法，也希望这本改编教材的出

版，会对国内双语教学的推广及物理教学与国际接轨做出有益的贡献。

在本书改编过程中，高等教育出版社的陶铮同志不厌其烦地与我多次磋商，确定改编方案。我的同事北京交通大学杨巽、张希清、吴柳、章小丽教授，华中科技大学的葛国勤教授等都提出了许多有益的建议。在与他们的讨论交流中，笔者受益颇多，谨此一并致以诚挚谢意。

改编英文原版教材是使优秀资源本土化的一种大胆尝试。限于笔者的水平和时间，改编版中的不足和错误一定不少，恳请广大同行和读者不吝指正。

滕小瑛

2004年11月于北京交通大学

符号使用说明：

1. “*”号对应的章或节属于扩展内容。其中有些是仅供读者课外阅读的内容，相应仅附思考题，无习题；有些是为满足不同层次学校和代课教师的选讲内容，附有思考题和习题，只是习题中加“*”号区别。
2. 书中习题前标有的（I）（II）（III）是原书中给出的，分别表示该题的难度级别。其中（I）为最易求解的题目。

Fundamental Constants

Quantity	Symbol	Approximate Value	Current Best Value[†]
Speed of light in vacuum	c	3.00×10^{8} m/s	2.99792458×10^{8} m/s
Gravitational constant	G	6.67×10^{-11} N·m²/kg²	$6.67259(85) \times 10^{-11}$ N·m²/kg²
Avogadro's number	N_A	6.02×10^{23} mol^{-1}	$6.0221367(36) \times 10^{23}$ mol^{-1}
Gas constant	R	8.315 J/mol·K = 1.99 cal/mol·K = 0.082 atm·liter/mol·K	8.314510(70) J/mol·K
Boltzmann's constant	k	1.38×10^{-23} J/K	$1.380658(12) \times 10^{-23}$ J/K
Charge on electron	e	1.60×10^{-19} C	$1.60217733(49) \times 10^{-19}$ C
Stefan-Boltzmann constant	σ	5.67×10^{-8} W/m²·K⁴	$5.67051(19) \times 10^{-8}$ W/m²·K⁴
Permittivity of free space	$\epsilon_0 = (1/c^2\mu_0)$	8.85×10^{-12} C²/N·m²	$8.854187817\ldots \times 10^{-12}$ C²/N·m²
Permeability of free space	μ_0	$4\pi \times 10^{-7}$ T·m/A	$1.2566370614\ldots \times 10^{-6}$ T·m/A
Planck's constant	h	6.63×10^{-34} J·s	$6.6260755(40) \times 10^{-34}$ J·s
Electron rest mass	m_e	9.11×10^{-31} kg = 0.000549 u = 0.511 MeV/c^2	$9.1093897(54) \times 10^{-31}$ kg = $5.48579903(13) \times 10^{-4}$ u
Proton rest mass	m_p	1.6726×10^{-27} kg = 1.00728 u = 938.3 MeV/c^2	$1.6726231(10) \times 10^{-27}$ kg = 1.007276470(12) u
Neutron rest mass	m_n	1.6749×10^{-27} kg = 1.008665 u = 939.6 MeV/c^2	$1.6749286(10) \times 10^{-27}$ kg = 1.008664904(14) u
Atomic mass unit (1 u)		1.6605×10^{-27} kg = 931.5 MeV/c^2	$1.6605402(10) \times 10^{-27}$ kg = 931.49432(28) MeV/c^2

[†]Reviewed 1993 by B. N. Taylor, National Institute of Standards and Technology. Numbers in parentheses indicate one standard deviation experimental uncertainties in final digits. Values without parentheses are exact (i.e., defined quantities).

Other Useful Data

Joule equivalent (1 cal)		4.186 J
Absolute zero (0 K)		–273.15°C
Earth:	Mass	5.98×10^{24} kg
	Radius (mean)	6.38×10^{3} km
Moon:	Mass	7.35×10^{22} kg
	Radius (mean)	1.74×10^{3} km
Sun:	Mass	1.99×10^{30} kg
	Radius (mean)	6.96×10^{5} km
Earth-sun distance (mean)		149.6×10^{6} km
Earth-moon distance (mean)		384×10^{3} km

The Greek Alphabet

Alpha	A	α	Nu	N	ν
Beta	B	β	Xi	Ξ	ξ
Gamma	Γ	γ	Omicron	O	o
Delta	Δ	δ	Pi	Π	π
Epsilon	E	ε	Rho	P	ρ
Zeta	Z	ζ	Sigma	Σ	σ
Eta	H	η	Tau	T	τ
Theta	Θ	θ	Upsilon	Υ	υ
Iota	I	ι	Phi	Φ	ϕ, φ
Kappa	K	κ	Chi	X	χ
Lambda	Λ	λ	Psi	Ψ	ψ
Mu	M	μ	Omega	Ω	ω

Values of Some Numbers

π	= 3.1415927	$\sqrt{2}$	= 1.4142136	ln 2	= 0.6931472	$\log_{10} e$	= 0.4342945
e	= 2.7182818	$\sqrt{3}$	= 1.7320508	ln 10	= 2.3025851	1 rad	= 57.2957795°

Mathematical Signs and Symbols

$\propto$	is proportional to	$\leqslant$	is less than or equal to
$=$	is equal to	$\geqslant$	is greater than or equal to
$\approx$	is approximately equal to	Σ	sum of
$\neq$	is not equal to	$\bar{x}$	average value of x
$>$	is greater than	Δx	change in x
$\gg$	is much greater than	$\Delta x \to 0$	Δx approaches zero
$<$	is less than	$n!$	$n(n-1)(n-2)\ldots(1)$
$\ll$	is much less than		

Unit Conversions (Equivalents)

Length

1 in. = 2.54 cm
1 cm = 0.394 in.
1 ft = 30.5 cm
1 m = 39.37 in. = 3.28 ft
1 mi = 5280 ft = 1.61 km
1 km = 0.621 mi
1 nautical mile (U.S.) = 1.15 mi = 6076 ft = 1.852 km
1 fermi = 1 femtometer (fm) = 10^{-15} m
1 angstrom (Å) = 10^{-10} m
1 light-year (ly) = 9.46×10^{15} m
1 parsec = 3.26 ly = 3.09×10^{16} m

Volume

1 liter (L) = 1000 mL = 1000 cm^3 = 1.0×10^{-3} m^3 = 1.057 quart (U.S.) = 54.6 $in.^3$
1 gallon (U.S.) = 4 qt (U.S.) = 231 $in.^3$ = 3.78 L = 0.83 gal (Imperial)
1 m^3 = 35.31 ft^3

Speed

1 mi/h = 1.47 ft/s = 1.609 km/h = 0.447 m/s
1 km/h = 0.278 m/s = 0.621 mi/h
1 ft/s = 0.305 m/s = 0.682 mi/h
1 m/s = 3.28 ft/s = 3.60 km/h
1 knot = 1.151 mi/h = 0.5144 m/s

Angle

1 radian (rad) = 57.30° = 57°18′
1° = 0.01745 rad
1 rev/min (rpm) = 0.1047 rad/s

Time

1 day = 8.64×10^4 s
1 year = 3.156×10^7 s

Mass

1 atomic mass unit (u) = 1.6605×10^{-27} kg
1 kg = 0.0685 slug
[1 kg has a weight of 2.20 lb where $g = 9.81$ m/s^2.]

Force

1 lb = 4.45 N
1 N = 10^5 dyne = 0.225 lb

Energy and Work

1 J = 10^7 ergs = 0.738 ft·lb
1 ft·lb = 1.36 J = 1.29×10^{-3} Btu = 3.24×10^{-4} kcal
1 kcal = 4.18×10^3 J = 3.97 Btu
1 eV = 1.602×10^{-19} J
1 kWh = 3.60×10^6 J = 860 kcal

Power

1 W = 1 J/s = 0.738 ft·lb/s = 3.42 Btu/h
1 hp = 550 ft·lb/s = 746 W

Pressure

1 atm = 1.013 bar = 1.013×10^5 N/m^2
= 14.7 lb/$in.^2$ = 760 torr
1 lb/$in.^2$ = 6.90×10^3 N/m^2
1 Pa = 1 N/m^2 = 1.45×10^{-4} lb/$in.^2$

SI Derived Units and Their Abbreviations

Quantity	Unit	Abbreviation	In Terms of Base Units†
Force	newton	N	kg·m/s^2
Energy and work	joule	J	kg·m^2/s^2
Power	watt	W	kg·m^2/s^3
Pressure	pascal	Pa	kg/(m·s^2)
Frequency	hertz	Hz	s^{-1}
Electric charge	coulomb	C	A·s
Electric potential	volt	V	kg·m^2/(A·s^3)
Electric resistance	ohm	Ω	kg·m^2/(A^2·s^3)
Capacitance	farad	F	A^2·s^4/(kg·m^2)
Magnetic field	tesla	T	kg/(A·s^2)
Magnetic flux	weber	Wb	kg·m^2/(A·s^2)
Inductance	henry	H	kg·m^2/(s^2·A^2)

†kg = kilogram (mass), m = meter (length), s = second (time), A = ampere (electric current).

Metric (SI) Multipliers

Prefix	Abbreviation	Value
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^9
mega	M	10^6
kilo	k	10^3
hecto	h	10^2
deka	da	10^1
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

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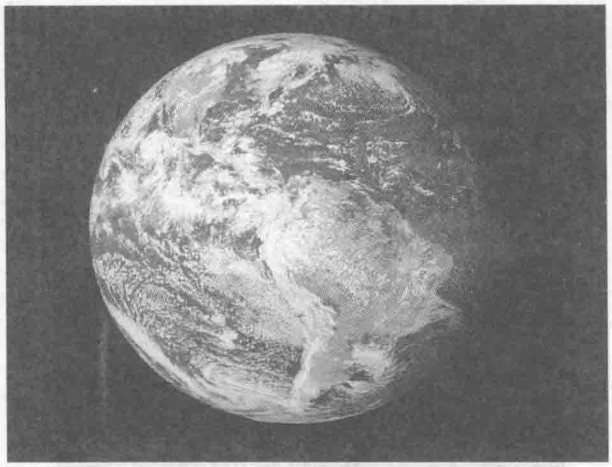

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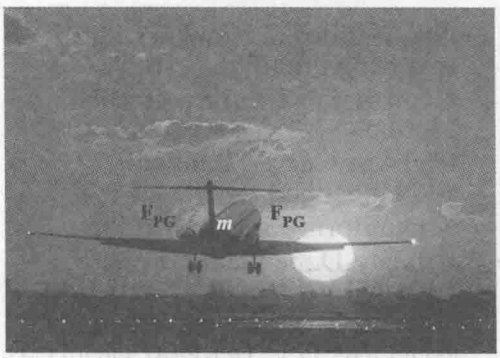

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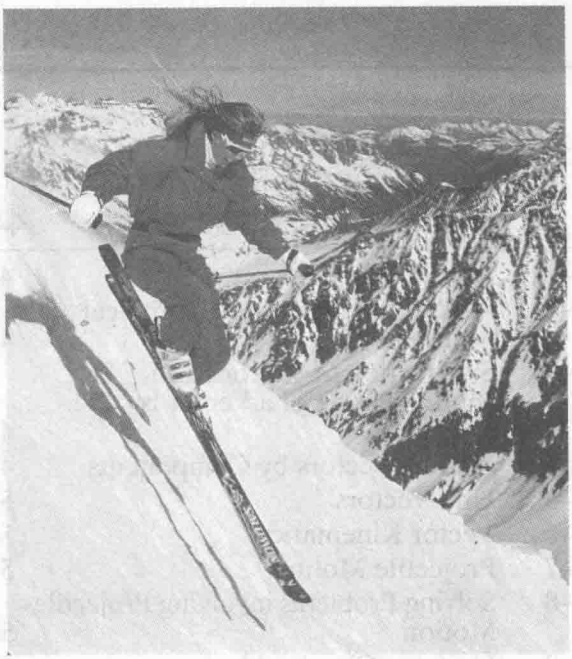

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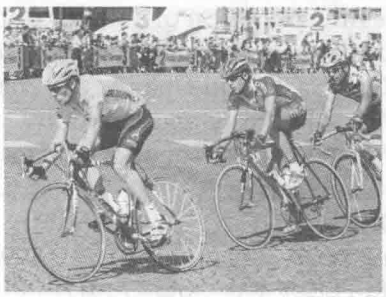

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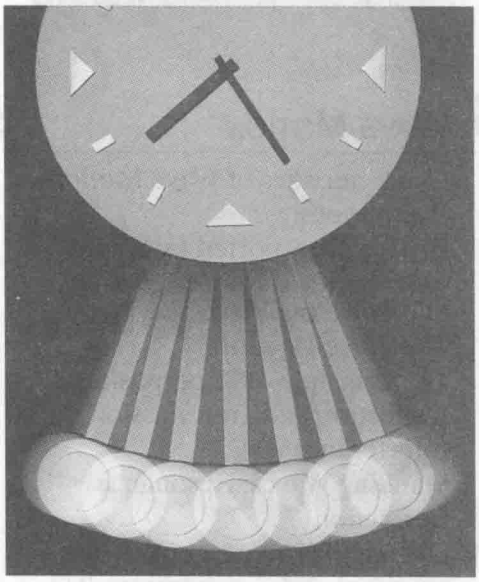

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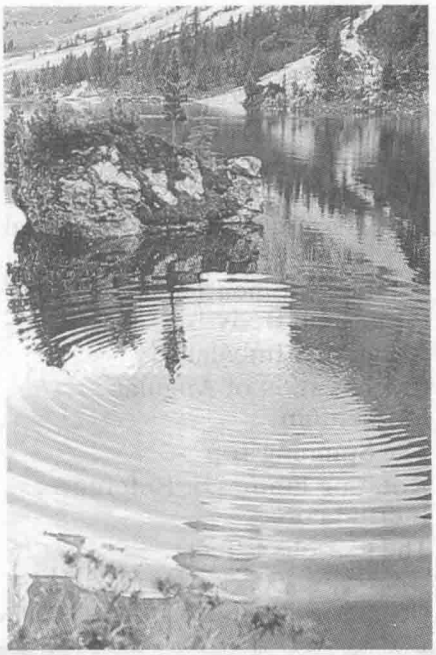

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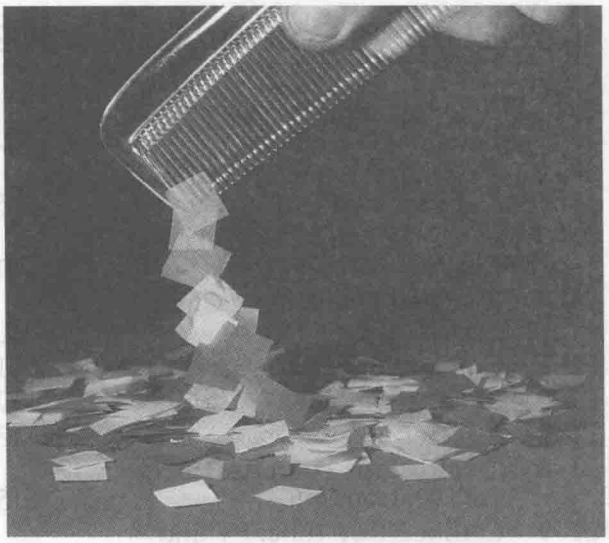

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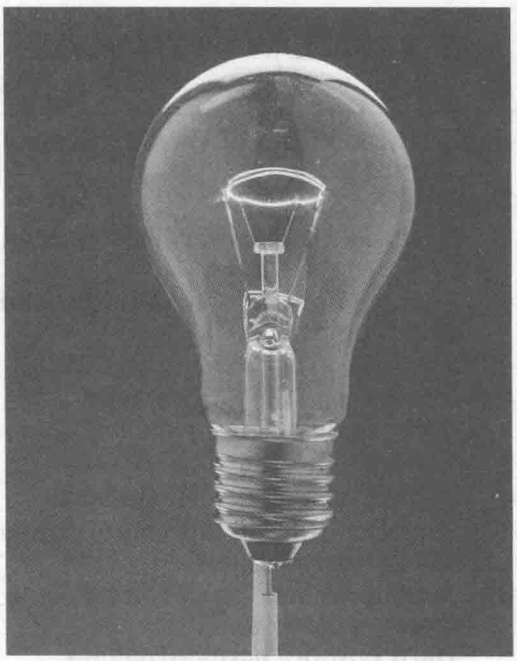

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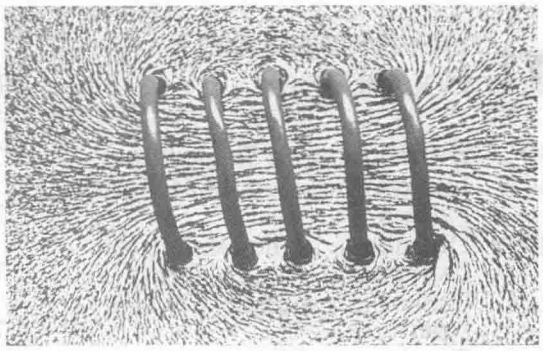

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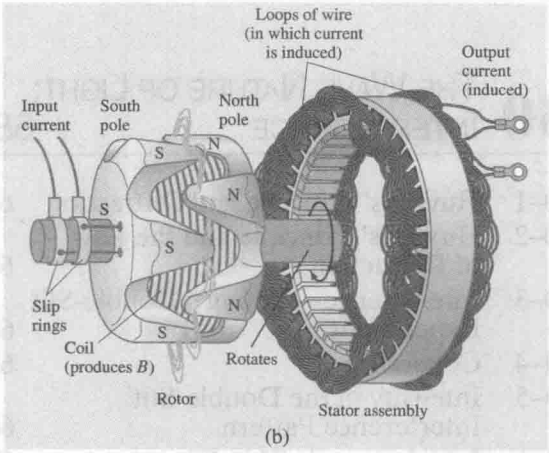

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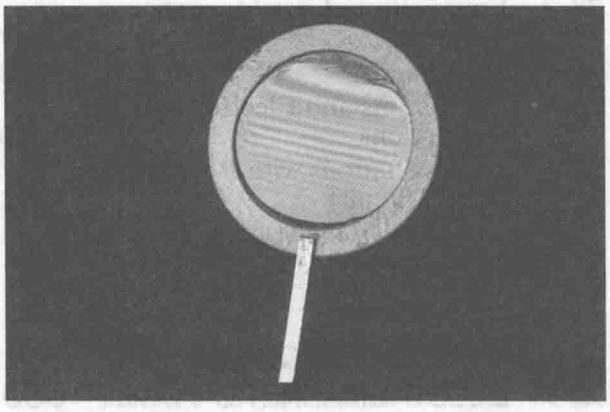

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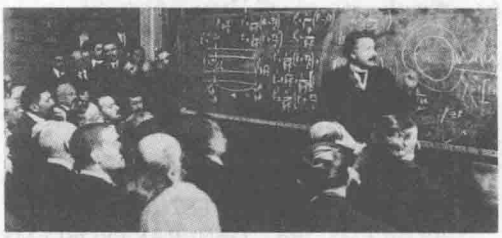

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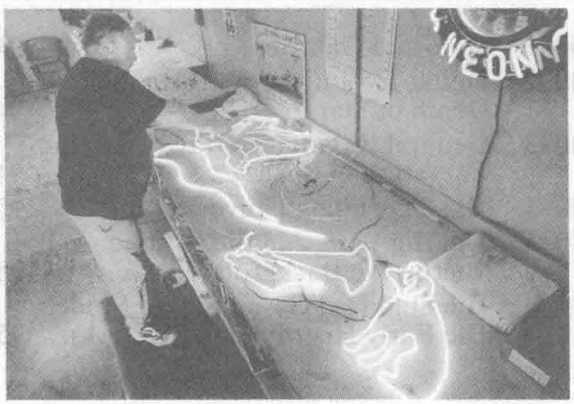

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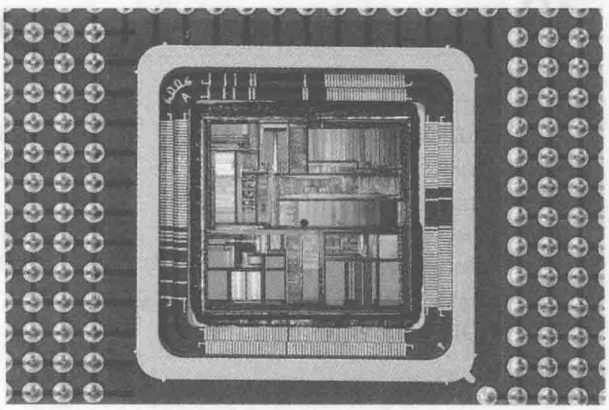

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