

1976 Award in Science Writing

Physics • Astronomy

Sponsored by

American Institute of Physics
United States Steel Foundation

For distinguished writing
about physics or astronomy
in a
newspaper or magazine
or book

Award for a scientist—
physicist, astronomer, or
member of AIP member society

Closes June 30, 1976
(for period of June 1, 1975
to May 31, 1976)

THE AWARD CONSISTS OF:
• \$1,500 Cash Prize
• Moebius Strip
• Certificate

For entry blank—fill in and mail this coupon to:

Public Relations
American Institute of Physics
335 East 45 Street
New York, New York 10017

Name

Title

Organization

Street Address

City, State, ZIP Code

Cagnac at the University of Paris and Pebay-Peyroula at the University of Grenoble have both been active in utilizing level-crossing and radiofrequency spectroscopy, and Cagnac has more recently been using resonant laser excitation. Pebay-Peyroula is also noted for his observations of atomic alignment produced by electron collisions in high-frequency discharges.

The aim of the authors appears to be the education of readers toward an understanding of modern experiments in atomic physics. The first volume and the first half of the second volume develop this aim, enabling the authors to spend the last sixty pages in describing modern experiments in optical and radiofrequency resonance spectroscopy, atomic excitation cross sections and decay rates, mesic atoms, and possible violations of parity and time-reversal invariances. The development is historical, with frequent comparisons between the theory and experiments, although the authors do not hesitate to depart from a chronological sequence of experiments where this appears more beneficial in explaining the theory. A particularly good sequence of examples occurs in the discussion of the angular momentum of atoms, electrons and photons: after an introduction to magnetic moments, the authors discuss gyromagnetic effects in terms of the Einstein and de Haas experiments and Barnett's reciprocal experiment; Larmor rotation and the Bloch equations lead to electron paramagnetic resonance and nuclear magnetic resonance; they introduce quantization through the Stern-Gerlach and Rabi experiments and the subsequent force electron ($g - 2$) measurements of Richard Crane and others. The angular momentum of photons is illustrated with the direct measurements by Richard Beth (1936) and Nello Carrara (1949) of the torque produced from polarized light.

The authors use physical models (well illustrated) very effectively, although in this respect I have two objections: the first is that more space is devoted to discussion of the Bohr and Sommerfeld theories of the hydrogen atom than to the quantum-mechanical models of Erwin Schrödinger, Wolfgang Pauli, and so forth. The second is that although the vector model for coupling of angular momenta is not discussed in the first volume, the authors then introduce it to explain the Zeeman and $L-S$ coupling effects in atomic magnetism. The vector model could very easily have been omitted or just mentioned in passing in volume 1, as the authors indicate in their excellent comparison of the Wigner-Eckart theorem with the vector model.

The two volumes cover a lot of ground in this large field of atomic physics, and it would be impossible to

include everything. One omitted subject, for example, is radiation of character other than the electric dipole, which is growing in importance with the advent of lasers (which themselves are scarcely mentioned in the text). Also, atomic structures of atoms containing more than two active electrons go essentially unmentioned.

The title *Quantum Theory and its Application* for volume 2 is a misnomer, as the authors freely admit that the reader is presumed to be familiar with the *Quantum Mechanics* of Albert Messiah. Thus, the volume consists solely of the applications of quantum mechanics in atomic physics.

Overall, I would have no hesitation in using these two volumes as the basis for a course in atomic physics at the level mentioned above. However, I think it would be helpful to everyone, in this age of economy, to have a cheaper paperback edition, as is the case for the much less expensive French version.

GORDON BERRY
University of Chicago
Illinois

Special Relativity

J. G. Taylor
106 pp. Oxford U.P., New York,
1975. \$10.75

John G. Taylor's exposition of special-relativity theory is a concise, no-nonsense text aimed at undergraduates in science. The maturity required of the reader is generally that gained by students in the advanced undergraduate curriculum of the physical and engineering sciences. One expects the most successful results with such a text from those who have overcome any past barriers in understanding the essentials of motion and time when expressed mathematically. Indeed this latter quality is usually the prerequisite for any attempt to understand special relativity from any source.

This book combines a modern and up-to-date viewpoint with a classical presentation; as such it provides a minimum number of learning barriers for the student. This is a great advantage over many other well-intentioned texts which hasten to bring in too much material not relevant to the foundations of understanding. The author gives an excellent account of experiments and verifications all through the text; the experimental side of the story is woven smoothly together with the mathematical analysis needed for the whole picture. The final work comes through as a consistent, well-formulated and understandable first course in relativity.

The first six chapters display good

organization of the basics. In chapter 6, Maxwell's electrodynamics are treated formally with tensor notation introduced, emphasizing more fully the general Lorentz covariance of the theory. The book concludes with two chapters entitled "The Structure of Special Relativity" (meaning the Lorentz group and representations) and "Extensions Of Special Relativity" (to faster-than-light particles and gravitation). Chapters 2 through 7 have exercises to be worked, with answers provided, and there are a number of examples worked out in the text material itself.

Although the work is well-rounded and concise and has excellent potential for its intended purpose, I feel there is possibly one point of weakness in the presentation. That point is the low profile given to the qualitative results of Lorentz geometry through space-time diagrams, in all chapters except chapter 3. Most books over the decades that have dealt with relativity in a chapter or so display this neglect, so certainly Taylor's *Special Relativity* is not alone. But a student audience has a natural tendency to grasp results as displayed by formulas and substitute these for understanding, and (as every physicist knows) physics is neither exciting nor understandable in terms of formulas. For example, one's understanding of time dilation, contraction of lengths, the clock paradox and accelerated frames becomes much clearer with the modified intuition supplied by space-time diagrams coupled with the predictive power of the Lorentz transformation. The algebra of the corresponding formulas could never provide the user with that kind of insight.

On the whole, the book is excellent and well-written. It should certainly be considered seriously by anyone desiring to teach or learn the fundamentals of a frequently misunderstood but exciting field.

GEORGE DEBNEY
Department of Mathematics
Virginia Polytechnic Institute
and State University
Blacksburg

Lunar Science: A Post-Apollo View

S. R. Taylor
372 pp. Pergamon, New York, 1975.
\$16.50 hardcover, \$9.50 paperbound

Stuart Taylor, a Professorial Fellow at the Research School of Earth Sciences of the Australian National University, is a trace-element geochemist, with experience in meteorites, tektites and chemical diversification of geological material; he is a charter member in the

GCA/Precision Scientific



Two new VacTorr® Direct Drive Vacuum Pumps

Efficiency: 60% or better at one micron

Powerful pumping mechanism in a lightweight, compact package—no belts, pulleys or other external moving parts. For example, Model DD-50 will deliver up to twice the capacity of similar size belt driven pumps. The DD-100, which weighs just 45 pounds, pumps 65 liters/min. at 1 micron Hg—outstanding efficiency for a pump of this capacity.

Concept of maximum capacity and compact design, plus quick pump-down and quiet operation make VacTorr two stage mechanical direct drives the versatile "go anywhere" vacuum pump. Ideal for use or storage anywhere in the laboratory—on benches, under counters, on shelving or in cabinets.

Ask your local GCA/Precision Scientific Dealer or write us. GCA/Precision Scientific, 3737 W. Cortland St., Chicago, IL 60647. Sales offices in principal cities.

Circle No. 40 on Reader Service Card

Better Teaching— By Design.



PASCO
Modular
System

PASCO is in the same business you're in — helping people learn. You do it by using your knowledge of science and your skill with people. We do it by designing equipment that's more versatile, more accurate, more rugged — equipment to help you and help your students.

One example is our new line of modular components for physics and biomedical instrumentation. These modules lock together in any combination to form sturdy instruments with many applications. Use them one way today, another way tomorrow. Let your students design specific instruments for specific experiments, and they'll learn more from the experience.

The modular system is described fully in our new catalog. So are other systems designed to make the teaching of physics more interesting and more effective.

Fill out the coupon below to get your copy of our catalog, and we'll send along our series of biographies of prominent physicists, suitable for display in your classroom.



PASCO scientific

1933 Republic Avenue • San Leandro, CA 94577 • (415) 351-1501

Name _____
Address _____
City _____ State _____ Zip _____

Circle No. 41 on Reader Service Card