Atomic Physics Before 1920

The Infancy of Atomic Physics. Hercules in His Cradle. ALEX KELLER. Clarendon (Oxford University Press), New York, 1983. x, 230 pp., illus. $18.95.

In this book Alex Keller gives a lively account of the development of atomic physics from 1870 to 1920. It is partly biographical, partly anecdotal, and partly thematic, focusing on the experimental discovery of new kinds of objects and effects: x-rays, electrons, alpha rays, new elements, the nucleus, and radioactive transmutation. By interweaving scientific issues with their popular reception, Keller makes his book quite enjoyable to read.

Keller's technique works particularly well when he contrasts the discovery of x-rays by Wilhelm Roentgen in 1895 with that of uranium rays by Henri Becquerel in 1896. While searching for "invisible rays" Roentgen noticed that his cathode-ray tube was clouding photosensitive paper even through a protective covering. After investigating the effects of various objects that were interposed between the tube and screen, the experimenter finally announced his discovery. Almost immediately Roentgen became a public figure, his images of skeletal limbs capturing the attention of the press, the public, and the royalty as well as the scientific community. The new rays provoked discussion everywhere from the *Illustrated London News*, *Punch*, and H. G. Wells's science fiction to the meetings of the British Association.

Present at one of the public presentations of x-rays was Becquerel, who was particularly interested in the presence of a phosphorescent patch on the cathode tube. Here, he suspected, was the source of the x-rays. Experimenting by analogy he (successfully) attempted to cloud sealed photographic paper with another phosphorescent substance, uranium potassium sulfate. But whereas hundreds of articles explored the properties of x-rays very few even mentioned Becquerel's discovery. It was two years before Marie Curie began testing other elements near uranium on the periodic chart to see if they too emitted a radiation. Much later it would become apparent that the "uranium rays" hid an enormous amount of crucial physics. But, as this case illustrates, the public acclaim elicited by physics discoveries often differed from the relative importance later assigned them. It would be fascinating to trace in greater detail how the publicity surrounding the discoveries discussed in Keller's book affected the scientists' own problem choices as well as those of their patrons and students.

The body of Keller's book is better than the introduction. In the opening pages the author deplores the lack of interest in the history of atomic physics: "At this moment we may have to choose between nuclear energy and a simpler way of life: atomic physics underlies our science, and most hopes for a continuing affluence. Why then has there been so little written in any detail about the strange birth and heroic infancy of that Hercules which is modern science?" There are several problems here. First, the science on which nuclear energy depends is nuclear physics, which is related only as a rather distant nephew to the early atomic models and studies of radioactivity that are the main subject of Keller's book. (Moreover, it is not at all clear how our continuing affluence is connected to atomic physics.) Second, there is in fact a huge literature on the history of 20th-century physics, a great portion of which is devoted precisely to the development of atomic physics. A quick browse through the now standard reference work, J. L. Heilbron and B. R. Wheaton's *Literature on the History of Physics in the 20th Century* (Office for History of Science and Technology, University of California, Berkeley, 1981), reveals more than 130 books and articles on the history of atomic physics before quantum mechanics and an additional 50 on the early history of radioactivity. Listed separately are works on topics such as the discovery of x-rays, for which 29 works are cited. One would never guess this from the text of Keller's book, where in 14 chapters—replete with several direct quotations per page—there are only 24 footnotes. Most chapters have one note or none at all. At the end of the book is an extremely short bibliography, the majority of which is devoted to biographies that Keller himself introduces as overly full of "admiration" and psychologically "superficial."

One consequence of the absence of documentation is that one cannot tell when Keller is intentionally disputing a standard claim or when he is rehearsing the physics history passed down through textbooks. For example, one of the most important moments in the history of atomic physics is Bohr's invention of the idea that orbiting electrons could orbit about their nuclei only at specific orbits with discrete energy levels. Fifteen years ago, in one of the few historical articles that Keller does cite, T. S. Kuhn and J. L. Heilbron (*Hist. Stud. Phys. Sci.* **1**, 211 [1969]) showed that radiative collapse was not Bohr's main worry in this endeavor, as Keller presents it as being. (Bohr thought he knew how to make the radiative loss small enough to neglect.) Instead he was struggling to make the atom stable against flying apart from electrostatic forces. Similarly, Keller's account of Planck's work loses by following a textbook account. It could have been both more accurate and more exciting had it taken into account the historical literature on the quantum discontinuity (for example, M. J. Klein, *Arch. Hist. Exact Sci* **1**, 459 [1962], cited but not used correctly by Keller, and T. S. Kuhn, *Black-Body Theory and the Quantum Discontinuity, 1894–1912*, Oxford Univ. Press, 1978, not even cited by Keller).

Despite these difficulties the book is enjoyable. The student doggerel and laboratory Christmas songs that break up the scientific story leave the reader with a sense of the excitement physicists felt at the beginning of the century as they came to know the atom.

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Quaternary Geology

The Pleistocene. Geology and Life in the Quaternary Ice Age. TAGE NILSSON. Reidel, Boston, 1983 (distributor, Kluwer Boston, Hingham, Mass.). 651 pp., illus. $115. Translation and revision of the Swedish edition (1972).

Younger members of the academic community may be encouraged by reading this lively, honestly opinionated, and current textbook written by a colleague who is approaching his 80th year. Based on a 1972 Swedish edition, the book has been thoroughly revised and expanded. Numerous references through 1981 are cited.

The 23 chapters of the book range in length from three or four pages to 80 pages. The 80-page chapter, on the Middle and early Late Pleistocene evolution in Europe, and a 70-page chapter on the last glacial stage in Europe make up more than a quarter of the book and will probably be of greatest interest to North Americans.

Raised in the grand tradition of stratigraphic and paleontologic correlation that was necessary prior to the widespread use of radiometric dating and isotopic temperature analysis, the author compiles numerous correlation charts of the bewildering stage and substage

"Herd of reindeer. Engraving on bone. Magdalenian, Dordogne." [After Kühn, from Grahmann and Müller-Beck; reproduced in *The Pleistocene*]

names that are in use in various countries and continents. His approach is intentionally conservative. Successive chapters list the conventional glacial stages of North America, northern Europe, and the Alps, together with their "conventional correlations." Chapters are organized on the basis of these correlations, which appear to be sound and reliable.

On reading only a short way into each chapter, newer and more radical ideas intrude. Traditional correlations are soon put into doubt, and the doubts are never resolved. A brief chapter on absolute dating methods does not sufficiently review the results of those methods. Age estimates for East European ice sheets based on thermoluminescence (p. 165) are given without comment. Radiometric ages for North American tephras (p. 375) obviously invalidate traditional European correlations, but the point is not stressed. The ages of at least three Pearlette Tuff beds are mentioned (p. 378) but are not used in any of the correlation charts. On page after page, this book shows the impact of the fast development of methodology.

Many figures from the well-known 1971 textbook by Flint and the 1969 textbook by Woldstedt (and their earlier versions) are copied by Nilsson in this book. Unfortunately, the use of these figures results in a nonuniformity of scale and technique that is quite distracting. The use of a figure from Flint's 1971 textbook that shows the distribution of Scandinavian erratics (p. 171) is surprising, for I would expect a Scandinavian author to have more current and primary references on this topic. Nilsson reproduces (pp. 394–395) the important but outdated maps of the proglacial North American Great Lakes from a 1963 article by Hough although Flint had already recognized their obsolescence in his 1971 book. Similarly, Nilsson reproduces (p. 397) a map of Lake Agassiz from a 1947 textbook by Flint without reference to any more recent sources.

Chapter 6 is a peculiar three-page essay or editorial on the Pliocene-Pleistocene boundary. It introduces a 12-page chapter on the related Italian stratigraphy, and together these chapters support the author's implicit long chronology for the age of the Pleistocene, which has been variously suggested to be 1 to 3 million years (p. 22), 2.3 to 3 million years (p. 24), about 2 million years (p. 352), and 1.8 to 2.8 million years (p. 411). This information could have been collected in a single section to facilitate more effective analysis.

The primary value of this book lies in the way in which each chapter integrates regional stratigraphy, palynology, botanical stratigraphy, mammalian paleontology, and anthropology. Each of these subfields of Quaternary science has its protagonists, and only a senior, experienced writer would have attempted the comprehensive overview that Nilsson has provided.

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Books Received

The ABC of Psychology. Leonard Kristal. Facts On File, New York, 1983. 253 pp., illus. $14.95; paper, $6.95.

Absorption on and Surface Chemistry of Hydroxyapatite. Dwarika N. Misra, Ed. Plenum, New York, 1984. viii, 179 pp., illus. $39.50. From a symposium, Kansas City, Mo., Sept. 1982.

Actions and Interactions of GABA and Benzodiazepines. N. G. Bowery, Ed. Raven, New York, 1984. xiv, 298 pp., illus. $36. From a symposium, London, March 1983.

The Addictive Behaviors. Howard Shaffer and Barry Stimmel, Eds. Haworth, New York, 1984. x, 172 pp. $22.95. Originally published in *Advances in Alcohol and Substance Abuse*, vol. 13, Nos. 1/2.

Advances in Clinical Neuropsychology. Vol. 1. Gerald Goldstein, Ed. Plenum, New York, 1984. viii, 189 pp., illus. $29.50.

Advances in Energy Cost Savings for Industry and Buildings. Fairmont, Atlanta, Ga., 1984. x, 498 pp., illus. $45. From a congress, Nov. 1983.

Beam Weapons. The Next Arms Race. Jeff Hecht. Plenum, New York, 1984. xii, 363 pp., illus. $17.95.

Beyond the Dyad. Michael Lewis, Ed. Plenum, New York, 1984. x, 335 pp., illus. $35. Genesis of Behavior, vol. 4. From a conference.

Biocontrol of Medical and Veterinary Pests. Marshall Laird, Ed. Praeger, New York, 1984. xx, 235 pp., illus. $39.95. From a symposium, Kyoto, Japan, Aug. 1980.

Biofuture. Confronting the Genetic Era. Burke K. Zimmerman. Plenum, New York, 1984. xii, 305 pp., illus. $16.95.

Chemistry and Biology of Pteridines. Pteridines and Folic Acid Derivatives. John A. Blair, Ed. Walter de Gruyter, New York, 1983. xxxiv, 1070 pp., illus. $128. From a symposium, St. Andrews, Scotland, Sept. 1982.

Child Abuse and Neglect. A Teacher's Handbook for Detection, Reporting, and Classroom Management. Cynthia Crosson Tower. National Educational Association, Washington, D.C., 1984. 112 pp. $14.95; paper, $7.95.

Cochlear Implants in Clinical Use. W. D. Keidel and P. Finkenzeller, Eds. Karger, Basel, 1984. viii, 176 pp., illus. $84. Advances in Audiology, vol. 2. From a symposium, Erlangen, Germany, 1982.

Cognition and Motor Processes. W. Prinz and A. F. Sanders, Eds. Springer-Verlag, New York, 1984. x, 378 pp., illus. $30. From a conference, Bielefeld, Germany, July 1982.

Cognitive Processing in the Right Hemisphere. Ellen Perecman, Ed. Academic Press, New York, 1983. xx, 257 pp., illus. $35. Perspectives in Neurolinguistics, Neuropsychology, and Psycholinguistics.

Collapse. The Buckling of Structures in Theory and Practice. J. M. T. Thompson and G. W. Hunt, Eds. Cambridge University Press, New York, 1984. x, 531 pp., illus. $79.50. From a symposium, London, Aug. 1982.

Comparative Psychology in the Twentieth Century. Donald A. Dewsbury. Hutchinson Ross, Stroudsburg, Pa., 1984 (distributor, Van Nostrand Reinhold, New York). xiv, 413 pp., illus. $34.95.

The Complete Computer Compendium. Michael Edelhart and Douglas Garr. Addison-Wesley, Reading, Mass., 1984. x, 278 pp., illus. Paper, $12.95.

The Computer Comes of Age. The People, the Hardware, and the Software. R. Moreau. MIT Press, Cambridge, Mass., 1984. xii, 227 pp., illus. $19.95. The MIT Press Series in the History of Computing. Translated from the French edition (Paris, 1981) by J. Howlett.

Concepts of Ecology. Edward J. Kormondy. 3rd ed. Prentice-Hall, Englewood Cliffs, N.J., 1984. xviii, 298 pp., illus. $19.95.

Controlled Clinical Trials in Urologic Oncology. Louis Denis *et al.*, Eds. Raven, New York, 1984. xx, 329 pp., illus. $49. Monograph Series of the European Organization for Research on Treatment of Cancer, vol. 13. From a symposium, Brussels, Oct. 1982.

Creative Evolution. Henri Bergson. University Press of America, Lanham, Md., 1984. lii, 507 pp. Paper, $12.75. Translated from the French edition by Arthur Mitchell. Reprint, 1911 edition.

Current Practices in Software Development. A Guide to Successful Systems. David King. Youdon, New York, 1984. xvi, 216 pp., illus. Paper, $28.

Deciphering the Senses. The Expanding World of Human Perception. Robert Rivlin and Karen Gravelle. Simon and Schuster, New York, 1984. 237 pp., illus. $15.95.

The Developing Person. A Life-Span Approach. Helen L. Bee and Sandra K. Mitchell. 2nd ed. Harper and Row, New York, 1984. xviii, 653 pp., illus. $26.95.

Eye Movements in Reading. Perceptual and Language Processes. Keith Rayner, Ed. Academic Press, New York, 1983. xxiv, 527 pp., illus. $52. Perspectives in Neurolinguistics, Neuropsychology, and Psycholinguistics.

Fast Nuclear Rotation. Adzisław Szymański. Clarendon (Oxford University Press), New York, 1983. x, 241 pp., illus. $39. Oxford Studies in Physics.

A First Course in Fluid Dynamics. A. R. Paterson. Cambridge University Press, New York, 1984. x, 528 pp., illus. $59.50; paper, $24.95.

Forgotten Children. Parent-Child Relations from 1500 to 1900. Linda A. Pollock. Cambridge University Press, New York, 1984. xii, 334 pp. $49.50; paper, $16.95.

Frogs of Western Australia. M. J. Tyler, L. A. Smith, and R. E. Johnston. Western Australian Museum, Perth, 1984. xii, 108 pp., illus. Paper, $A9.95.

Functional Histology. Myrin Borysenko and Theodore Beringer. 2nd ed. Little, Brown, Boston, 1984. x, 400 pp., illus. Paper, $24.95.

Gas Chromatography/Mass Spectrometry Applications in Microbiology. Göran Odham, Lennart Larsson, and Per-Anders Mårdh, Eds. Plenum, New York, 1984. xvi, 444 pp., illus. $59.50.

Genetic Aspects of Speech and Language Disorders. Christy L. Ludlow and Judith A. Cooper, Eds. Academic Press, New York, 1983. xiv, 221 pp., illus. $29. From a conference, Bethesda, Md., 1981.

Glacial Lake Agassiz. James T. Teller and Lee Clayton, Eds. Geological Association of Canada Publications, Business, and Economic Services, Toronto, 1983. vi, 451 pp., illus. C$34; to members, C$28. Geological Association of Canada Special Paper 26. From a symposium, Winnipeg, May 1982.

Groundwater Contamination. National Academy Press, Washington, D.C., 1984. xii, 179 pp., illus. Paper, $17.95. Studies in Geophysics.

Handbook of Physiology. A Critical, Comprehensive Presentation of Physiological Knowledge and Concepts. Sections 1, The Nervous System. John

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