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