# BOOKS

## THERE WERE GIANTS IN THOSE DAYS

**THE COLLECTED PAPERS OF LORD RUTHERFORD OF NELSON Vol. 3. The Cavendish Laboratory. Under scientific direction of Sir James Chadwick. 428 pp. Interscience, New York, 1965. $15.00.**

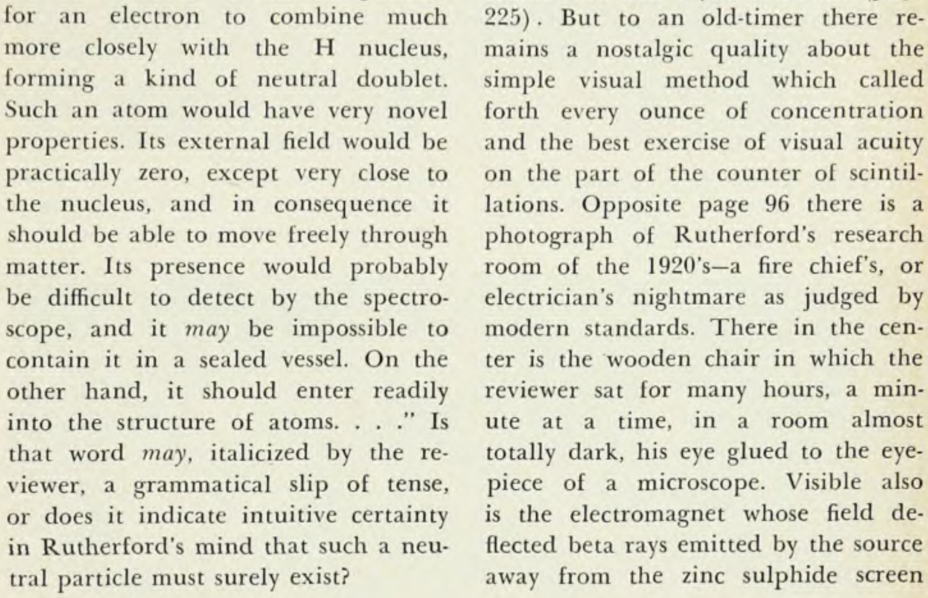
*by Thomas H. Osgood*

Sir James Chadwick's foreword describes the undertaking to publish the collected works of Lord Rutherford in four volumes, divided according to recognizably different periods of his life and work, carried on in different locales. This third volume of the series covers his Cavendish Professorship at Cambridge between the years 1919 and 1937.

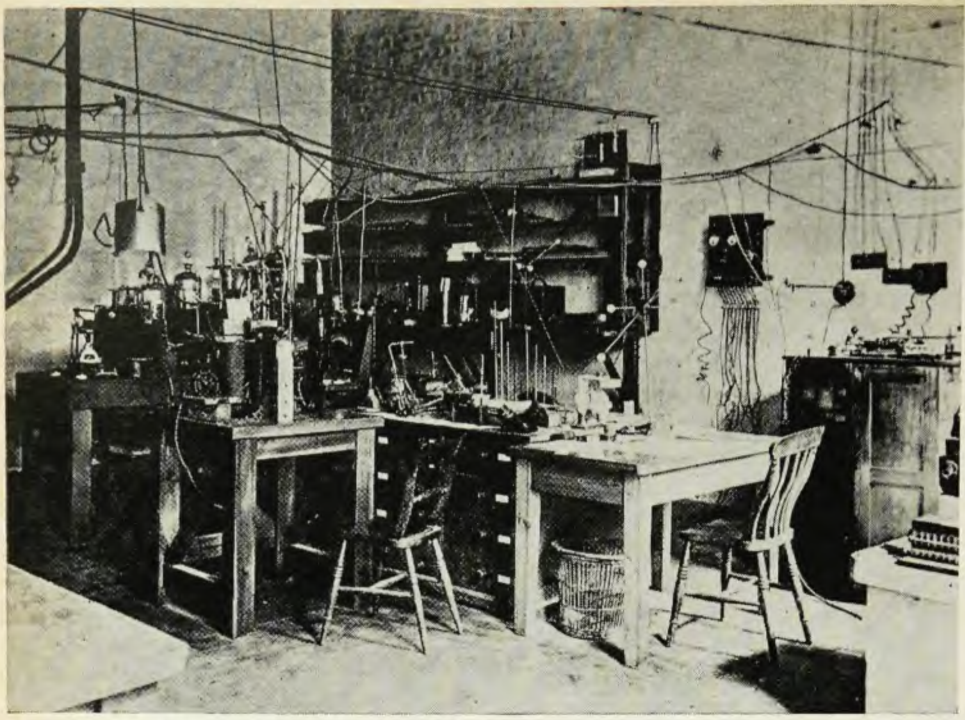
To those who worked at the Cavendish during those years, any account of the work of their hero Rutherford makes good reading. This collection of nearly forty reprinted papers is essentially a history of the experimental discovery of the properties of the atomic nucleus—from the discovery that some radioactive nuclei emit alpha particles in groups of different ranges, all the particles of any one group possessing essentially the same energy, to the transmutation of the nuclei of light elements under impact of protons, alpha particles or deuterons. At that time, occasional experiments on the nucleus were done in several laboratories throughout the world, but from none of them came the sustained series of discoveries here recorded, obtained without complex equipment, set forth in simple language, which, in its logical cogency, almost seems to make inevitable the disclosures that are to follow.

The 1920's were, of course, the time of the century during which the atomic nucleus was presumed to contain protons and negative electrons. The existence of the neutron was not clearly demonstrated until 1932. But a rereading of the second paper in this volume, Rutherford's Bakerian Lecture of 1920, suggests that he was not entirely happy with the accepted concept of nuclear structure. He speculated at some length on the "possible existence of an atom of mass 1 which has zero nucleus charge. Such an atomic structure," he writes, "seems by no means impossible. On present views, the neutral hydrogen atom is regarded as a nucleus of unit charge with an electron attached at a distance, and the spectrum of hydrogen is ascribed to the movements of this distant electron. Under some conditions, however, it may be possible for an electron to combine much more closely with the H nucleus, forming a kind of neutral doublet. Such an atom would have very novel properties. Its external field would be practically zero, except very close to the nucleus, and in consequence it should be able to move freely through matter. Its presence would probably be difficult to detect by the spectroscope, and it *may* be impossible to contain it in a sealed vessel. On the other hand, it should enter readily into the structure of atoms. . . ." Is that word *may*, italicized by the reviewer, a grammatical slip of tense, or does it indicate intuitive certainty in Rutherford's mind that such a neutral particle must surely exist?

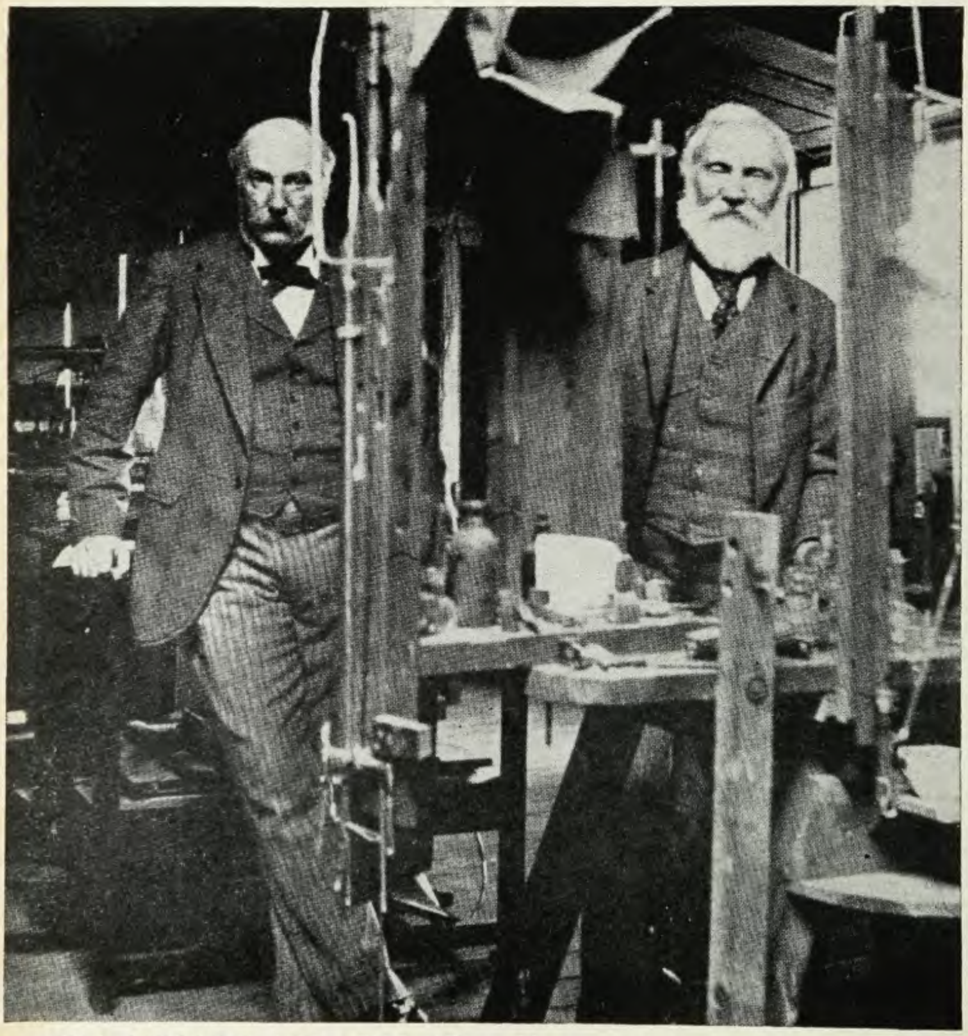
The years 1929–30 saw a revolution in the method of counting alpha particles and a rapid increase in the rate and accuracy of making measurements —a change from the visual scintillation to the electrical method. The results of the application of this method to a survey of some nuclear problems are set out in the paper of Rutherford and Wynn-Williams (page 225). But to an old-timer there remains a nostalgic quality about the simple visual method which called forth every ounce of concentration and the best exercise of visual acuity on the part of the counter of scintillations. Opposite page 96 there is a photograph of Rutherford's research room of the 1920's—a fire chief's, or electrician's nightmare as judged by modern standards. There in the center is the wooden chair in which the reviewer sat for many hours, a minute at a time, in a room almost totally dark, his eye glued to the eyepiece of a microscope. Visible also is the electromagnet whose field deflected beta rays emitted by the source away from the zinc sulphide screen



**A GROUP OF OLD FRIENDS gathered informally on the occasion of a meeting of the Bunsengesellschaft in Münster in 1932. (Snapshot by the late F. Paneth.) Left to right: Chadwick, von Hevesy, Frau Geiger, Geiger, Lise Meitner, Rutherford, Hahn, Stefan Meyer, Przibram. From *The Collected Papers of Lord Rutherford of Nelson*, Volume 3, *The Cavendish Laboratory*.**



**RUTHERFORD'S RESEARCH ROOM in the Cavendish Laboratory, where the reviewer spent many hours watching a scintillation screen. From *The Collected Papers of Lord Rutherford of Nelson,* Vol. 3, *The Cavendish Laboratory.***



**LORD RAYLEIGH AND LORD KELVIN in Rayleigh's laboratory at Terling, his country home. From *Scientific Papers,* by Lord Rayleigh (Dover edition).**

lest the screen become so bright as to drown out the tiny flashes made by alpha or H particles. Lying on a cluttered table at the right of this chair is a portion of the special right-angled microscope described on page 49 of the volume. And far to the right in the picture are the chair and table at which Rutherford sat with Chadwick looking over his shoulder when, at the conclusion of a day's experiments, the lights were turned on and a preliminary analysis of the observations could be made.

To young scientists in the United States who work in laboratories that house a hundred or two hundred graduate students and staff, and who know that in Rutherford's time the Cavendish was the world's outstanding nuclear center, the comparatively small size of the group (including research students and professors) may come as a surprise. The group photographs of the years 1921 and 1937 show the total numbers of staff plus research students to be 29 and 52 respectively. But those were years of world peace, before science had reached its present political and military importance.

As a frontispiece, the volume has a good black and white reproduction of the 1932 portrait of Rutherford by Sir Oswald Birley, which hangs on the stairway of the Royal Society's suites in Burlington House, Piccadilly.

The book should be in every physics library, and will later be an important collection of papers in the history of science. But everyone who knew Rutherford well will want a copy for himself.

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*The reviewer is professor of physics and director of the Abrams Planetarium at Michigan State University. He was a research student at the Cavendish Laboratory from 1923 to 1925.*

SCIENTIFIC PAPERS. By Lord Rayleigh (John William Strutt). Vol. 1, 2, 598 pp; Vol. 3, 4, 568 pp; Vol. 5, 6, 718 pp. Dover, New York, 1965. $30.00 per set.

*by R. B. Lindsay*

It may truthfully be said that the late 19th and early 20th centuries saw the last of the great giants of physical science, men like Helmholtz, Stokes, Kelvin and Rayleigh, who could take the whole of physics for their field of activity and make lasting contributions to a wide variety of problems. Of all these, Lord Rayleigh seems the closest to us today, partly because he outlived the others and partly because in the enormous range of his scientific activity he touched on so many problems which have had great importance for contemporary physics.

It is therefore with particular satisfaction that we greet the appearance of this reissue of Rayleigh's collected scientific papers, which have been long out of print. The first edition was published by the Cambridge University Press in six volumes, the first five of which came out during Rayleigh's lifetime, in 1899, 1900, 1902, 1903, and 1912, respectively. The sixth was published in 1920, the year following his death. The present reprint covers all six volumes, but is bound in three for convenience. It must be confessed that they form very substantial volumes indeed and are a trifle awkward to handle.

Considerable interest is added to this reprint through the incorporation in Volume One of a 16-page supplement containing photographs relating to Rayleigh as well as reproductions of certain pages from his laboratory notebooks. Most of the latter are now in the possession of the Air Force Cambridge Research Laboratories in Bedford, Massachusetts, with copies deposited in Imperial College, London, and in the Niels Bohr Library of the American Institute of Physics. John N. Howard, chief scientist of the Air Force Cambridge Laboratories and editor of *Applied Optics*, has contributed to Volume Three a brief but highly useful bibliographical note with references to sources of biographical information about Rayleigh.

Practically everything that can be said about Rayleigh has already appeared in print in numerous places. Yet as we turn the pages of these volumes we cannot cease to wonder at the remarkable versatility of an individual who could move with such ease from questions in electricity to problems in acoustics, and from theoretical calculations of considerable complexity to ingenious experimental devices and arrangements. In a style that is clarity itself but also thoroughly relaxed the author seems almost to be conversing with the reader about his difficulties and how he overcame them. It is amusing to note that Rayleigh felt himself bothered in 1874 by a problem that we consider peculiarly characteristic of the science of our time, as this quotation from his review of Isaac Todhunter's *History of the Mathematical Theories of Attraction and the Figure of the Earth from the Time of Newton to that of Laplace* (1873) amply testifies:

> Scientific men must often experience a feeling not far removed from alarm, when we contemplate the flood of new knowledge which each year brings with it. New societies spring into existence, with their Proceedings and Transactions, laden with the latest discoveries, and new journals continually appear in response to the growing demand for popular science. Every year the additions to the common stock of knowledge become more bulky, if not more valuable; and one is impelled to ask, Where is this to end?

We today may perhaps feel like echoing Rayleigh's question: "Where, indeed?"

The 446 scientific papers included in these volumes constitute a veritable gold mine for the historian of late 19th and early 20th century physics. Practically every scientific contribution made by Rayleigh, with the sole exception of his monumental *Theory of Sound* (1877) either appears here in full or is abstracted. As in the original edition, though the papers are printed in chronological order irrespective of subject, in the final volume the contents are summarized and classified according to subject, thus making it comparatively easy to locate any paper of the author in any one of the twelve fields among which the articles are distributed. The valuable index of names has also been preserved from the first edition.

The volumes are a model of book production from the standpoint of paper, typography and illustrations.

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*Dean Lindsay is the author of an historical and biographical introduction to a reprinted edition of Rayleigh's* Theory of Sound.

# Space-group theory

**AN INTRODUCTION TO MATHEMATICAL CRYSTALLOGRAPHY. By M. A. Jaswon. 125 pp. American Elsevier, New York, 1965. $6.00.**

*by H. M. Otte*

As Jaswon points out in his preface, space-group theory was completed by 1890 and no new results can be expected. However, considerable scope remains for fresh presentations and interpretations, thus making the subject more readily accessible for important applications. In the limited space that the author allowed himself, this laudable objective is in part achieved, but the monograph—for this is what the publication really is—suffers, understandably, from many shortcomings.

The approach taken by Jaswon concentrates attention upon the motif structure, the microscopic arrangement of atoms which repeats itself periodically throughout any crystalline matter. An account of the 32 crystallographic point groups appears in the first three chapters, based upon intuitive geometrical considerations which are then supplemented by formal group theory and the development of a systematic notation for point-group operators. The next four chapters deal with space lattices followed by one on the Bravais space groups and three on screw axes and glide planes. At the end of each chapter there are generally a few problems involving proofs or demonstrations based on the material in the chapter.

Vector and matrix methods are used throughout the monograph; tensors are not mentioned. There are seven (untitled) appendices which include a proof that the reciprocal of a body-centered monoclinic lattice is a face-centered monoclinic lattice and a deviation of the relation between a point and its image with respect to a given mirror plane. Following the appendices is a bibliography listing only about a dozen articles and books; there is also a short index. Like the text, the bibliography seems eclectic and contains no reference to such classics as Seitz's papers [Zeit. Krist., 88, 433 (1934); 91, 336