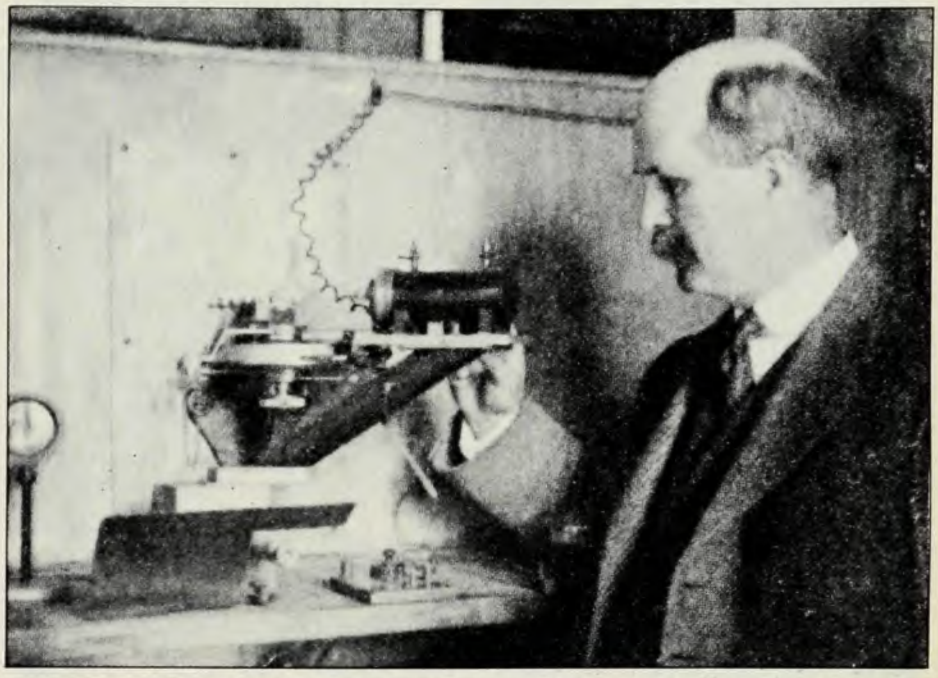
books

The elder Bragg: a daughter's warm sketch

William Henry Bragg 1862–1942: Man and Scientist

G. M. Caroe
212 pp. Cambridge U.P., New York, 1978.
$16.95

Reviewed by Roger H. Stuewer



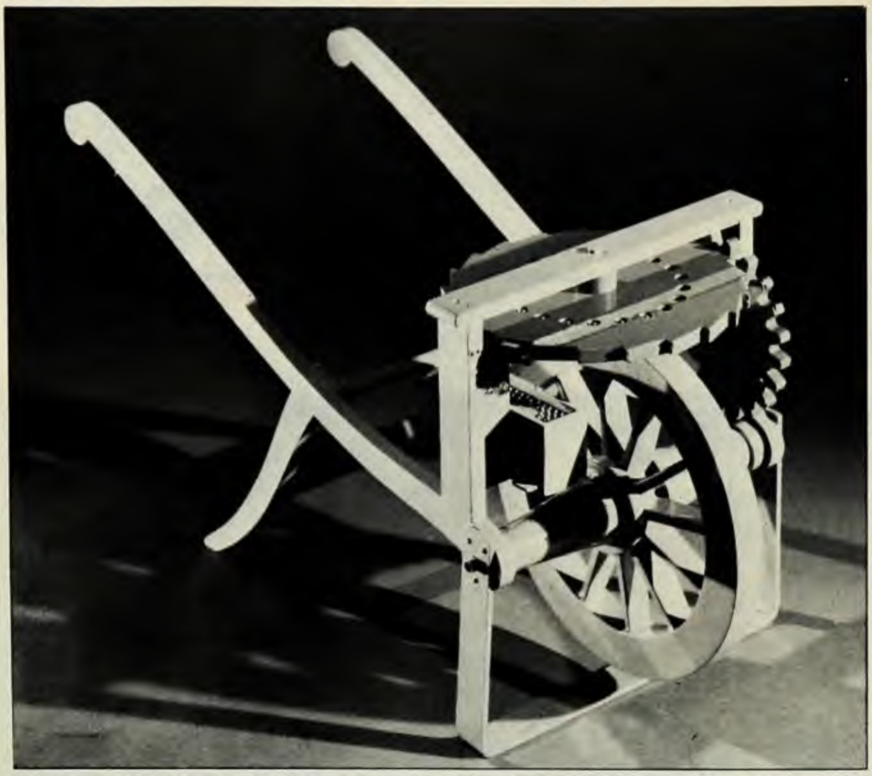
William Henry Bragg is shown here with his spectrometer at University College London, where he lectured from 1914 to 1923. A biographical account of Bragg by his daughter is reviewed below.

This biography of William Henry Bragg, the famous crystallographer, has been written by his only daughter, Gwendolen Mary Caroe (née Bragg). Herself a nonscientist, Caroe has quite naturally concentrated on the personal aspects of her father's life, while relying on E. N. da C. Andrade's account in the *Obituary Notices of Fellows of the Royal Society* (volume 4, 1943) and other sources for insight into his scientific achievements. Her original hope—to write an integrated biography jointly with her brother, William Lawrence Bragg—was thwarted by the latter's busy schedule and personal reluctance to undertake the task until it was too late—Sir Lawrence died in 1970 at the age of 80, shortly after completing the manuscript of his last book, *The Development of X-ray Analysis* (London: G. Bell & Sons, 1975). Caroe was therefore compelled to persevere alone and, drawing on her father's extensive personal and scientific correspondence, she has produced a warm sketch of him as a human being.

Bragg's grandfather was a country vicar, and his father a merchant seaman who retired from the sea in 1854 at the early age of 25 and bought a farm near Wigton, close to the Scottish border in Cumberland. In 1861 he married Mary Wood, who bore him three sons—Bragg, born in 1862, was the eldest—before she died in 1869 at age 36. For the next six years Bragg's education was placed in the hands of his assertive uncle William, who had just reestablished the old grammar school in Market Harborough, some 50 miles northwest of Cambridge. His father then reclaimed him, demanding that he enroll in King William's College, near Castletown on the Isle of Man. Six years later, in 1881, he won an 1851 Exhibition Scholarship and entered Trinity College, Cambridge, reading mathematics. In 1884 he took the rigorous Tripos examination and was ranked Third Wrangler (that is, he placed third). His professional career was launched the following year when, through a combination of fortunate circumstances and a good word from J. J. Thomson, he was appointed Professor of Mathematics and Physics at the University of Adelaide in distant Australia at the handsome salary of £800 per annum.

Caroe notes that her father's career as a physicist was unusual in at least three respects: First, he engaged in no research whatsoever until about age 40 when, as President of Section A of the Australasian Association for the Advancement of Science, he had to deliver the presidential address in Dunedin, New Zealand, in January 1904. Choosing radioactivity as his subject, he read up on it, was intrigued by some of Marie Curie's results, and began experimenting. At the same time, he opened up a correspondence with Ernest Rutherford at McGill University in Montreal, waiting patiently the necessary three months for Rutherford's replies. According to Caroe, Rutherford, ten years Bragg's junior, subsequently became perhaps the only lifelong intimate friend Bragg had, owing to the latter's natural shyness.

Second, Caroe notes the father–son collaboration that won the two Braggs the Nobel Prize in Physics in 1915. In 1889 Bragg had married Gwendoline Todd, daughter of Charles (later Sir Charles) Todd, and in the following years the couple had raised a family of two sons, William Lawrence (born in 1890), Robert Charles (born in 1891, killed in 1915 at Gallipoli), and one daughter, Gwendolen Mary (the author, born in 1907). By 1909, only a few years after he had entered the laboratory, Bragg's well known alpha-particle absorption experiments and gamma-ray scattering experiments had established his scientific reputation and, after almost two and one-half decades in Australia, he returned home to England, to the University of Leeds, with his family. Caroe graphically depicts her parents' despair over their radically altered circumstances at Leeds, where her father almost had to begin his career anew, and where her mother was appalled at the general poverty around her.



The "waywiser" or hodometer, a device for measuring surface distances, was designed by Leonardo da Vinci based on an idea by Vitruvius. A wheel with measured circumference turned a horizontal wheel through various gears in such a way that each time it completed a revolution, a pebble would drop in the box (located behind the wheel in the model shown above). This model, together with Leonardo's original drawings, appears in Charles Gibbs-Smith's *The Inventions of Leonardo da Vinci,* Scribner's, New York, 1978 (110 pp.; $12.95 clothbound, $7.95 paperbound). (Photo: International Business Machines)

Bragg's scientific work, nevertheless, continued: During 1909–12 he carried on a famous debate with C. G. Barkla over the nature of x rays and gamma rays, and from 1912 to 1914, following von Laue's discovery, he and his son William Lawrence opened up the entire field of x-ray crystal analysis. The initial triumph here, of course, was scored by the younger Bragg, who discovered the "Bragg equation" in 1912 while a student at Cambridge reading mathematics. Caroe sensitively recounts the subsequent heartache and frustration her brother felt for many years when people, including many physicists, simply assumed that it was her father who had either discovered this equation outright or had stimulated its discovery by his son. This contributed to a degree of tension or reserve between father and son that was never fully dissipated, even though they shared the Nobel Prize of 1915, and even though they agreed to an arbitrary division of work in the field they had opened up.

Finally, Caroe emphasizes the prominent role her father played as a public statesman and spokesman for science, beginning in 1914 after his transfer to University College London, but especially after 1923 when he was appointed Director of the Royal Institution. The "long and happy exile" in Australia appears to have prepared him for his public role; clearly, his mastering of the lecturer's art there was essential to his later success as a lecturer to children and adults at the Royal Institution, and as a frequent broadcaster on scientific topics on the BBC beginning in 1924, shortly after the founding of the Corporation.

At one point (page 172) Caroe summarizes her father's approach to life by recalling his attitude toward one of his predecessors at the Royal Institution:

> WHB often expressed his reverence for Michael Faraday; I believe they would have felt akin. I do not compare them in magnitude of scientific achievement, but in outlook and character. Each had the same humility of thought, the same awe before creation; both tried to impart their vision and enjoyed especially, I think, sharing their enthusiasm as they lectured, and especially as they lectured to children. Both helped their country; each remained unsophisticated, simple to the end.

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Shell-Model Applications in Nuclear Spectroscopy

P. J. Brussaard, P. W. M. Glaudemans
452 pp. North-Holland, New York, 1977. $65.50

From a severely jaundiced viewpoint, the subject matter of the present monograph can be characterized as the description of a complex many-body system utilizing a model with no cogent theoretical underpinning and based on an unknown Hamiltonian. Though I don't share such sentiments, as will be evident from the following paragraphs, such opinions are by no means confined to the rank outsider. The much heralded volumes of the Copenhagen masters, *Nuclear Structure,* vols. 1 and 2 (Benjamin, 1969 and 1975), by Aage Bohr and Ben Mottelson (overwhelmingly authoritative and almost equally unreadable), hardly recognize the core subject-matter (as opposed to the purely theoretical techniques) of the monograph by P. J. Brussaard and P. W. M. Glaudemans. This requires some explanation.

Of course every card-carrying nuclear physicist accepts the single-particle shell model as the basis of his or her professional existence: That the major effect of the strong two-body forces between nucleons is to produce for atomic number A sufficiently large (in practice $A \geq 5$), an average potential that explains (among others) such dominant features as the magic numbers of closed shells and the low-lying (single-particle) spectra of nuclei immediately adjacent to these. It is even admitted widely that the Brueckner–Bethe theory with recent refinements and elaborations provides a reasonable justification for this part of the theory.

A divergence of interest or viewpoint occurs at the next stage of the model-making. The shell model for the study of nuclei with two or more nucleons removed from closed shells is a theory of (mainly) low-lying bound states allied to a corresponding vintage approach in atomic physics. It is based (with some oversimplification in the statement) on the following three premises:

- The nearest major closed-shell nucleus can be treated as an inert core;
- the low-lying states are to be constructed from a finite number of basis vectors chosen by restricting the active particles to a few orbits identified from the closed-shell ±1 spectra (this restriction defines the model space whose maximum size is often determined by computer capacity); and
- eigenvectors in the model space are