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Acta Cryst. (1979). A**35**, 1085

Early History of the Union

Dr R. C. Evans, the first General Secretary of the Union, is preparing a history covering the first few years of the Union's existence and the events which led up to the establishment of the Union. He would be very pleased to hear from anyone who has recollections or correspondence of this period, prior to 1950, and may be contacted at 55 Boxworth Road, Elsworth, Cambridge CB3 8JQ, England.

Acta Cryst. (1979). A**35**, 1085

Radiation Leakage around X-ray Tube Shields

The Union's Commission on Crystallographic Apparatus recommends that the radiation level around X-ray tube shields should be carefully checked, because considerable leakage has been detected in some laboratories. Particular care should be taken when high-energy tubes are used and when tubes made by one manufacturer are enclosed in shields made by a different manufacturer.

Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

Acta Cryst. (1979). A**35**, 1085–1086

Introduction to the theory of thermal neutron scattering. By G. L. Squires. Pp. VII + 260. Cambridge University Press, 1978. Price £16·00.

The book has its origin in lectures given at a summer school at Cambridge in 1973. This is a theoretical book which consists of nine chapters and nine appendices. Problem examples are given at the end of each chapter (except 1, 2 and 5), and their solutions are given at the end of the book. The titles of the chapters are: *Introduction*, *Nuclear scattering – basic theory*, *Nuclear scattering by crystals*, *Correlation functions in nuclear scattering*, *Scattering by liquids*, *Neutron optics*, *Magnetic scattering – basic theory*, *Scattering from magnetically ordered crystals*, *Polarization analysis*. The appendices contain summaries of results of quantum mechanics and solid-state physics relevant to the subject of thermal neutron scattering.

Most of the chapters have a similar, well planned structure. They start with simple definitions then, using properties of the scattering system and results of quantum mechanics and solid-state physics (from the appendices), the scattering cross section for thermal neutrons is derived. The plan of the book is quite efficient. The basic problem of nuclear scattering is derived first, the extension to crystals, correlation function techniques, liquids and magnetic systems follows very smoothly.

As the author's preface explains, the book is intended for experimenters in the field of thermal neutron scattering who wish to see the theoretical ideas in a not too formal manner. As an experimenter, it seems to me that one can indeed find theoretical ideas and derivations for most of the formulae he has been using in the field of thermal neutron scattering.

Hence, the author's intention is well executed. I also feel that teachers and students of graduate courses in solid-state physics and quantum mechanics may find parts of this book quite useful. In conclusion this is a theoretical book, welcome on the shelves of experimenters of thermal neutron scattering, and physics, chemistry and material science libraries in universities and research institutes.

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Acta Cryst. (1979). A**35**, 1086–1087

William Henry Bragg 1862–1942: man and scientist. By G. M. CAROE. Pp. xii + 212. Cambridge Univ. Press, 1978. Price £8·95.

When I saw the title of the book *William Henry Bragg* 1862–1942: *man and scientist*, written by his daughter G. M. Caroe, I tried to make guesses about the possible content. With probably many other Europeans on the continent, I shared the belief that English Nobel laureates can grow up only in either Cambridge or Oxford as precious orchids and flourish really well only in a greenhouse under well controlled conditions. On the whole the book proved me wrong.

It is true that WHB spent three years, between 1882 and 1885, at the Trinity College of Cambridge, but in mathematics, not physics. He applied successfully for the post of professor of mathematics and of physics at the then 12-year-old University of Adelaide – it was then 1886 – and had to learn physics in Australia where he was to spend 23 happy years. There are charming stories in the book on the (literally) warm Adelaide atmosphere, on WHB's marriage to Gwendolyn Todd (born there), daughter of Sir Charles Todd, General Postmaster, Inspector (and builder) of Telegraphs and ... astronomer! No wonder that all W. H. Bragg's children were born in Australia, including Sir W. Lawrence Bragg who graduated from Adelaide University.

Of course WHB became perfectly aware of contemporary physics and popularized the newest findings not by presenting equations or photographs, but by redoing the experiments for the largest possible audience. Röntgen's discovery of X-rays was materialized in WHB's laboratory in spite of protests of some members of the clergy against the 'revolting indecency of the invention'. WHB was not only a marvellous teacher but wrote long papers on how and what to teach, which were initially published in the local press, but later developed into government reports. This crusade for education lasted for his entire long life. Education was his favourite subject in his Presidential Address to the Royal Society. His 'Children's Lectures' at the Royal Institution of London became famous and the BBC was keen to use WHB as a popularizer of science until the end. In fact in the series *Science lifts the veil*, organized by WHB, his dialogue with J. D. Bernal on *The problem of the origin of life* was broadcast on Monday 12 March 1942, three days before WHB's death.

Now what about crystallography? You might be surprised to learn that WHB's interest in research arose in the field of radioactivity when he was already over forty. In fact in 1904 he had the courage to start a correspondence with Rutherford, then in Canada. This reviewer does suspect – without any proof – that there were metaphysical links between WHB's stay in Australia and Rutherford's birth in New Zealand. Anyhow there was an everlasting friendship between these men, testified by letters as long as 30 pages! Whilst Rutherford was interested in the transformed atoms, WHB studied the radiation emitted by radioactive materials. At that time the identity of γ-rays from a radioactive emitter and of X-rays from a Röntgen tube was by no means evident. Bragg, to explain the effects of γ-rays, had invented a theory of a 'neutral pair'; for him γ-rays were neutral (whence the doublet) and corpuscular. There was a long fight between Barkla and WHB, which is reported in the book. Whilst Barkla had shown the light-wave-like nature of (soft) X-rays by a beautiful polarization experiment (Nobel prize, 1917), WHB continued to defend with vigour his corpuscular theory, feeling that the light wave was not the whole story. He wrote to Rutherford with imaginative prescience (letter of 18 January 1912) 'the energy travels from point to point like a corpuscle: the disposition of the lines of travel is governed by wave theory'. (Much later Louis de Broglie and Erwin Schrödinger solved the wave *versus* particle dichotomy.) The Barkla controversy darkened WHB's stay in Leeds until he saw the famous paper by von Laue, Friedrich and Knipping, realized its importance and called it at once to the attention of his son William Lawrence (WL).

At this point the educated reader would guess that the Bragg father WHB, a learned mathematician, had discovered the 'Bragg law' $n\lambda = 2d \sin \theta$ and that the Bragg son, WL, had helped with the experiment. It was just the other way around.

There is no doubt that WL had 'his brain wave', says the book, and discovered the famous diffraction equation. There is no doubt either that WHB's X-ray spectrometer was the first reliable tool for elucidating structures and that WHB recognized at once the potential of X-ray crystallography.

In another circumstance it was WHB who originated the idea of representing the electron density by a Fourier expansion and WL who wrote the paper. WL remarks regretfully 'he (WHB) should have published the idea and I should have published the application of diopside'.

In fact their fruitful collaboration lasted only two years, 1912–1914, and brought the Nobel prize in 1915, shared by father and son, a unique event in the history of science. There is no mention about the ceremony itself, 'wartime had stopped them working together suddenly and completely' and, after the war was over, they decided to divide the huge field; WHB would attack the organic part and WL the inorganic crystallography. 'Together they put British X-ray crystallography in a position of pre-eminence which lasted for two generations' says Caroe's book.

Astbury, Bernal, Kathleen Lonsdale (née Yardley), Muller and Shearer were co-workers of WHB. This does not mean that crystallography in organic chemistry ceased with WHB's death. His son, Sir Lawrence Bragg (knighted in 1941), godfathered organic crystal chemistry with quite concrete results, manifested in other Nobel prizes: Perutz, Kendrew (proteins), Dorothy Hodgkin (B12), Crick, Watson and Wilkins (DNA).

In view of the current impact of crystallography in almost all branches of science, it is amazing to learn that in World