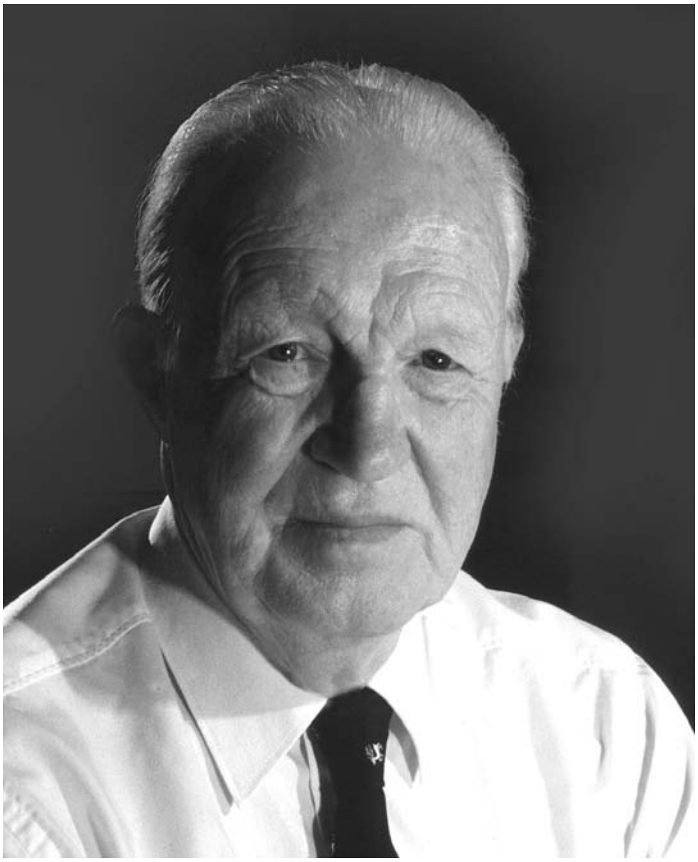
Acta Cryst. (1999). A**55**, 103–104

Professor Alexander F. Moodie



75 years

In the course of the fifty years since he joined the Chemical Physics Section of CSIRO in Melbourne, Alex Moodie has been a key figure in some of the major developments in electron diffraction and electron microscopy. He has been a leader in the development of the theoretical basis for the formulation and application of many-beam dynamical diffraction processes. He has made important contributions to the instrumental techniques and he has demonstrated how the methods may be applied to current problems of solid-state science. His influence on the development of the subject areas has been profound and much broader than may be suggested by a review of his publications. Alex has always preferred oral communications to written ones. He has always taken a lively interest in what everyone around him is doing and his enthusiasm and insight have stimulated the creativity of many of his colleagues. His ability to share his great enthusiasm for new ideas and concepts has been an inspiration on many occasions.

The early work on the multislice formulation of dynamical electron diffraction, a new approach to the problem of the dynamical interactions of large numbers of diffracted electron beams, was the basis for the award to Alex and his associate John Cowley of the first Ewald Prize of the International Union of Crystallography. This was a development originating from his re-discovery of the Fourier-image phenomenon (the Talbot effect), which had been buried in the literature and lost for almost 50 years. After developing a proper theoretical description for this phenomenon, based on Alex's profound knowledge of physical-optics theory, he and John Cowley realised that the optics of self-focusing periodic objects could lead to a new, physical-optics, approach to the description of the interaction of electron waves with crystals. A particular significance of this 'multislice' formulation of the dynamical diffraction theory is that it forms the basis for most of the computer programs used for the simulation of the high-resolution electron-microscope images of crystals. It is also routinely used in the computation of electron diffraction intensities, particularly in the form of convergent-beam electron diffraction patterns.

Alex was greatly involved in the discussions that led to the first attempts by John Sanders and John Allpress to use an electron microscope to form direct images showing the arrangements of atoms in projections of the structure of thin crystals. He was largely instrumental in establishing the use of computer simulations to interpret such images, through his classical paper with Peter Goodman in 1974 and the series of papers with various co-authors that explored and tested the methods. In more recent years, particularly with Harry Whitfield, he demonstrated how the imaging and computing methods may be refined to provide greater accuracy in the interpretation of the structure images (or 'lattice images', as Alex would say).

Many who have had the opportunity to work with Alex are in awe at his wide range of abilities, not least the ability to inspire colleagues. This was nowhere more evident than in the design and building of the first purpose-built convergent-beam electron diffraction camera. Not only did Alex have a deep understanding of the instrumental requirements, and the flair for design that enabled these requirements to be met, but he also exhorted the group to overcome major hurdles through months of long days and nights, inspiring them to a more rapid conclusion by plying them with Scottish humour and take-away chicken.

Amongst Alex's other developments in instrumentation was the first successful high-resolution high-temperature stage for an electron microscope, used subsequently in studies of the surface structure and reactions of ceramics.

All these achievements were facilitated by the Chemical Physics Section (later Division), a laboratory characterized in its early years by a remarkable blend of generosity and a fundamental belief in science and discovery. Under the leadership of Lloyd Rees, it fostered vitality and originality in research, of which Alex's is a prime example.

In further theoretical work, Alex, with Jon Gjønnes, made the important discovery that features in convergent-beam electron diffraction patterns (the GM lines) give clear indications of crystal symmetries and led the way to the development of the methods for the unambiguous determination of crystal space groups from observations made under dynamical diffraction conditions.

Alex has often sought to cast dynamical theory into forms that afford new physical insights. Through his clever use of approximations, he has identified practical conditions for which diffracted intensity distributions may be intuitively interpreted. He has also exploited the symmetries underpinning scattering equations to find conditions for which many-beam scattering mimics the form of two-beam scattering. It was such an approach that led Alex to derive a unique analytical inversion of three-beam diffracted intensities from centrosymmetric structures.

Alex has been an inspiration to young scientists, not only through his effervescent enthusiasm and erudition, but especially through his nurturing of their intellectual development. It is some indication of his success as a research supervisor that a number of electron microscopy laboratories around the world have a 'graduate' of the Moodie school as their director.

In the period since his retirement from CSIRO in 1988, Alex Moodie, as a Professor at the Royal Melbourne Institute of Technology, has continued a programme of active involvement with applications of diffraction and microscopy methods to such materials as the high-T_c superconductors. He also continues his theoretical work, combining his profound knowledge of theoretical physics with his background in dynamical diffraction to reformulate the theory of electron diffraction, as in his contribution to *International Tables for Crystallography*, and to explore the possibilities for extracting structure-factor amplitudes and phases from three-beam dynamical effects.

It is with profound respect for a productive career, rich in innovation and insight, that we honour Alex Moodie on the occasion of his 75th birthday.

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