As a scientific director, we addressed him as Monsieur Bertaut. His research strategy was based on a parallel development of the synthesis of new compounds and crystallography methods. His students had to understand and use these new methods that he taught with enthusiasm and the new materials they grew had to be not only theoretically interesting but also industrially useful. Monsieur Bertaut did not hesitate to initiate PhD works on innovative instrumental projects, in spite of the risk incurred. Once given the thesis subject, he left students quite free to carry out their research on their own. In fact, his personality was sufficient to induce an innovative research atmosphere. He had a lot of ideas ranging from realistic ones to totally impossible others. In most of the laboratory meetings he was the youngest in mind, although he was 25 years older than all the others.

He was an eclectic man, learning latin, greek, french, english, law, then chemistry and crystallography and, as mentioned by Professor Andre Guinier (Guinier, 1969–1972), 'Félix Bertaut is a mathematician who does crystallography'. Félix Bertaut has been concerned with different aspects in crystallography. After his PhD work where he first discriminated the grain size itself from the grain size distribution (Bertaut, 1950, 1952), he solved the structure of complex compounds like the pyrrhotite with a non-stoechiometric composition $Fe_{1-x}S$. He developed the so-called *Structure factor algebra* (Bertaut, 1957, 1959*a*,*b*). He contributed enormously to the development of neutron crystallography. He extended the use of group theory in crystallography, particularly to magnetic structures (Bertaut, 1968). When the IUCr decided to finalize the Symmetry Group International Tables, he belonged to the *ad hoc* committee and particularly contributed to the definition of magnetic groups (Bertaut & Wondrastschek, 1971). He used the group theory to anticipate all the magnetic structures compatible with the crystal symmetries. This 'Bertaut method' was very useful for complex structures and even more so with the lack of computers. Of course his students had to apply this method in any case. In parallel, he did not forget his chemistry background and in his two laboratories chemistry syntheses continuously fed crystallography studies, mainly for a better understanding of magnetism.

Félix Bertaut and his laboratories became internationally renowned in crystallography, in neutron diffraction and in magnetism. The first International Conference on Neutron Scattering was held in Grenoble in 1963. It was at the banquet of this conference that the construction of a European high-flux neutron reactor was first suggested by Neel in a speech prepared by Félix Bertaut. Then, with the support of Louis Neel, Félix Bertaut promoted this project and convinced his German collaborators. He was certainly convincing, and this was a good idea at the right time. The French and German peoples, under the leadership of de Gaulle and Adenauer, were re-establishing new friendly relationships at this time. Thus the high-flux neutron reactor was created. As Grenoble was considered as a major place in magnetism with Neel and a neutron diffraction pole with Bertaut, this institute was built in Grenoble. Its name, Institut Laue-Langevin (ILL), nicely expresses the association of crystallography and magnetism. Initially French–German, the ILL became European and was a key partner for building the European Synchrotron Facility in Grenoble. This synchrotron radiation source is particularly used for crystallography and also for magnetic nanostructure studies. Seeds scattered by Neel, Bertaut and their colleagues are now springing up.

The scientific renown of Félix Bertaut is international. He contributed largely to the IUCr committees like the International Tables Commission and the Neutron Diffraction Commission. He was the chair of the Charge, Spin and Momentum Density Commission (1975–1978), the IUCr representative to the IUPAP Commission on Solid State (1966–1972) and a Member of the IUCr Executive Committee (1975–1981). He was the editor or a co-editor of numerous scientific revues. From 1958 to 1982 he was a scientific advisor of various institutes (CEA, CNRS, ILL and Max Planck Institut, Stuttgart). Awarded several prizes and acknowledged as Professor Honoris Causa of various Universities, he was appointed full member of the French Academia of Sciences in 1979.

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Félix Bertaut, space groups and the *International Tables for Crystallography*

The acquaintance between Félix Bertaut and myself started in 1953, more than fifty years ago, in 'Penn State' (Pennsylvania State University, USA), where Félix was a research fellow in Ray Pepinsky's laboratory and where I often went from the MIT in Cambridge to do 'automatic' Fourier syntheses on the famous analogue computer X-RAC. Our friendship developed even stronger when we found out that his birthplace, Leobschütz, and that of my mother, Kattowitz, were located rather close to each other in Upper Silesia (now Poland); the subsequent cordial family relations included one of his daughters, Isabelle, doing babysitting for our son in Frankfurt in 1963, and my wife and I being spontaneously invited in Grenoble to a swinging party celebrating the 'thèse de troisième cycle' of one of Félix's students. These visits in Aachen and Grenoble became even more frequent when he was on the board of the KFA Jülich and I on the board of the ILL in Grenoble.

Our major scientific collaboration, however, occurred from 1972 onwards with the preparation of the new Volume A of *International Tables for Crystallography*, published in 1983. The official start of the new International Tables Commission, with Félix Bertaut among its founding members

and one of its most active collaborators, was in 1972, but the real work began in August 1973 at St Nizier near Grenoble during a meeting prepared and organized by Félix. Already at this meeting and later at the various 'Aachen meetings' in 1977–1979, the spirit was 'high': the various national 'schools' of crystallography clashed over such issues as trigonal *versus* rhombohedral and monoclinic *c*-axis *versus b*-axis setting (the so-called 'monoclinic monster'). Félix, with his sharp and critical mind, stayed above such 'professorial politics', realising quickly the merits but also the shortcomings of a proposed solution. Fortunately, after the working hours, international friendship was restored by 'vin rouge et fromage'.

Félix Bertaut's contributions to Volume A are noteworthy and will not be forgotten. He wrote Chapter 4 on '*Synoptic Tables of Space-Group Symbols*' with extended Hermann–Mauguin symbols, many interesting and individualistic examples of group–subgroup relations and historic recourses to former editions of International Tables. As a second contribution, Yves Billiet and he wrote Chapter 13 on '*Isomorphic Subgroups of Space Groups*', opening the way to the treatment of this infinite set of subgroups in the actual space-group tables. Beyond these special topics, he has contributed greatly to the success of the entire volume by quick recognition of novel ideas and old errors.

As a German, this writer wants to stress that Félix Bertaut was an unusually strong and successful advocate of the French–German cooperation and friendship in science and among scientists after the last world war. This is not only obvious from Félix's contribution to neutron diffraction and the establishment of the ILL in Grenoble, but also from numerous visits in Germany, as well as personal contacts and support of young scientists. For these efforts he is highly respected in both countries.

I want to close this reminiscence of our friend Félix on a humerous note (which would be quite in his spirit), quoting a few passages from his letters which illuminate the personal and human side of this wonderful man.

(On his 80th birthday:) 'For the group of order 80, I must tell you that I prefer 90, but it will take more time than the International Tables.'

'Le secret de la jeunesse d'esprit, en accord avec un collègue danois, c'est une action difficile à définir, mais facile à identifier.' (The secret of mental youth, according to a Danish colleague, is a phenomenon difficult to define, but easy to identify.)

'Reiselust ist eine Krankheit, die nur durch noch mehr Reisen geheilt werden kann.' (Travel urge is a desease which can be cured only by more travelling.)

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Sivaraj Ramaseshan (1923–2003)

Sivaraj Ramaseshan, distinguished crystallographer, materials scientist and much else, died at Bangalore on 29 December, 2003, at the age of 80, after a prolonged illness. He leaves behind his wife Kausalya and three daughters.

Born in Kolkata (formerly Calcutta) on 10 October, 1923, he graduated from the University of Nagpur before joining the great scientist C. V. Raman in the Physics Department of the Indian Institute of Science in 1943. After obtaining his doctorate, he continued as a faculty member in the Department. His early work was concerned with magnetism and optics. He turned to crystallography in the first half of the fifties and quickly established a vibrant crystallographic group at Bangalore. Among the many contributions that emanated from the group, particular mention may be made of the two-wavelength method for solving crystal structures using anomalous dispersion, which in fact forms the basis for the currently hugely popular multiple anomalous dispersion (MAD) method. He moved to the Indian Institute of Technology, Madras, in 1962, where he continued his crystallographic researches. While at IIT, he spent a year in Dorothy Hodgkin's laboratory at Oxford, which marked the beginning of several life-long friendships.

He returned to Bangalore in 1966, now to start a materials science laboratory at the National Aeronautics Laboratory. This turned out be the beginning of his outstanding contributions in the area and their use for important applications. He continued to pursue fundamental research in physics and crystallography as well. In addition to the work in his own laboratory, he contributed to the development by other institutions of products such as heart valves, blood bags and components for aerospace applications. He was appointed as Joint Director of the Indian Institute of Science in 1979 and Director in 1981, from which position he formally retired in 1984. During his second tenure at the Institute, he initiated several important scientific and technological programmes.

His post-retirement phase proved to be extremely productive and useful. He was deeply involved in the administration of the Indian Academy of Sciences, of which he was President during 1983–1985, and the Raman Research Institute, Bangalore. He took a keen interest in Academy publications, particularly the journal *Current Science*, of which he was editor from 1989 until his death. Particular mention must also be made of the publication by the Academy of the collected works of Dorothy Hodgkin, which he coedited, in three volumes.

Ramaseshan has been honoured with many fellowships and awards. He served the International Union of Crystallography in several capacities, including as its Vice-President (1981–1984). Remarkably, a substantial proportion of crystallographers in India are his academic descendents.

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