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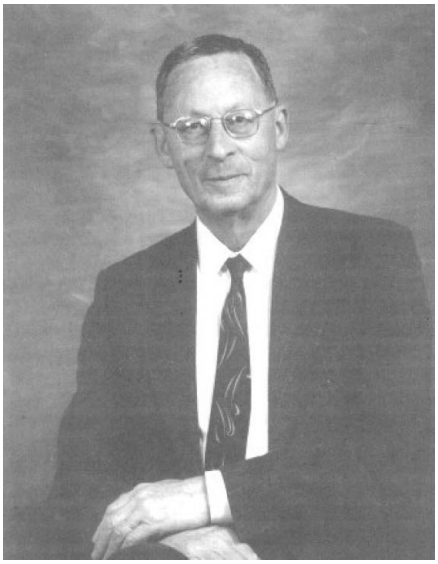
crystallographers

Erwin Félix Lewy-Bertaut (1913–2003)



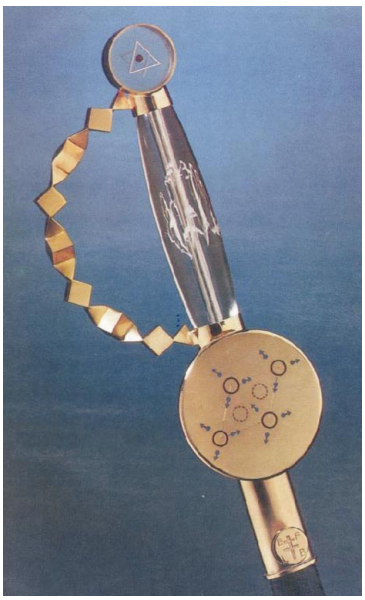
Erwin Félix Lewy-Bertaut, crystallographer, CNRS honorary research director and member of the French Académie des Sciences, deceased in Grenoble on 6 November 2003.

Born in 1913 in Leobschütz (presently in Poland but at the time in Germany), he was an undergraduate in law. The political change in Germany in 1933 and the subsequent persecution of the Jewish people, convinced him to emigrate to Paris. Finally, he reached Bordeaux where he was a graduate student in chemistry. In February 1939, just before the Second World War, he interrupted his PhD thesis on colophany to join the French Army. After the French defeat, he received a temporary identity card under the name Félix Bertaut. He had a chemistry position in the 'free' southern part of France where he improved the resistance of bike brakes, made of cork, the bicycle being the quasi-exclusive way of transportation at this time. To avoid police controls, with the help of Alfred Kastler (Kastler, 1994), he joined the Laboratoire Central des Poudres where he learned how to use the *International Tables of Crystallography*. Following another police control he had to escape and was sent to work with Professor Louis Neel (Neel, 1970) in Grenoble, located at the time in the 'free area' of France.

Professor Louis Neel was studying magnetism and the crystallography notions of Félix Bertaut were very useful to this small research team (most of them 'emigrated' from France or elsewhere). Erwin Lewy obtained a CNRS research fellowship at the CNRS under the name Félix Bertaut and, under Neel's supervision, he contributed to the first large CNRS laboratory outside Paris: the Laboratoire d'Electrostatique et de Physique du Métal (LEPM) in Grenoble. With Jacques Mehring, he constructed a crude X-ray apparatus. At the same time, Louis Weil succeeded in synthesizing small-particle iron powders which would be very good materials as permanent magnets. Hence, Félix Bertaut chose a new thesis subject: *Study of size statistical distribution of iron grains by means of X-rays*. His thesis also presented an industrial aim since these magnets were used in bike dynamos. Furthermore, this grain-size distribution was needed for Louis Neel's studies on magnetism. Félix Bertaut defended his PhD thesis in February 1949 under the professorship of André Guinier. The method developed by Bertaut (Bertaut, 1950, 1952) is always a reference in powder granulometry.

Professor Erwin Félix Lewy-Bertaut with Professor André Guinier when he was appointed a full member of the French Academia of Sciences in 1979.

Just after his thesis in 1949, his scientific destiny underwent a substantial change of direction following a single-page publication by C. G. Shull (Shull, 1994) and J. S. Smart who evidenced the 'antiferromagnetic' order in MnO by neutron diffraction (Shull & Smart, 1949) and confirmed the theory proposed some 15 years before by Louis Neel (Neel, 1932, 1936). Neel became enthusiastic and wanted to perform similar studies in Grenoble. To improve his knowledge on this topic, Félix Bertaut visited the United States, first in 1951, and then in 1953 with the support of a Fulbright grant. In spite of the McCarthy atmosphere, with the help of Ray Pepinsky he could visit the Brookhaven National Laboratory centre and the neutron diffraction experiment of Lester Corliss and Julius Hastings. With the French decision to install an atomic research centre in Grenoble (CENG) under the direction of Louis Neel, Félix Bertaut created the 'Diffraction Neutronique' laboratory, headed by himself from 1958 to 1976. During this time the LEPM increased in size and was eventually split into several laboratories in 1971; the CNRS Laboratoire de Cristallographie is one of them, also headed by Félix Bertaut from 1971 to 1982. All these laboratories are located in a new large area, a past military artillery 'polygon', bought for a symbolic price by Louis Neel. During this time, Félix Bertaut, Francis Forrat and René Pauthenet became famous with their discovery of garnet ferrites (Pauthenet & Blum, 1954; Bertaut & Forrat, 1956). Now, garnet ferrites are a key material for magnetic memories and for high-frequency electronics.



Garnet ferrites also have the honour of being incrusted on the Félix Bertaut Academy's sword.

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