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Alfred Kastler FREE

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alized Onsager's solution to the "frustrated" case of the triangular lattice and calculated perhaps the only rigorous zero-point entropy of a non-trivial system.

Although his foray into gas-phase atomic and molecular physics was brief, he made two seminal contributions, both published in 1953. His theory of the transport properties of ions in gases stood for 20 years as the best and most utilized description of ion mobilities and diffusion coefficients. His classic work on the threshold behavior for ionization of atoms by electron impact is still relevant today, and, to quote Wannier, "more carefully reasoned than other papers of mine which are more popular."

In his later years he was engrossed in the problem of energy bands in the presence of electric and magnetic fields. Although it was unfashionable at the time, his efforts led to deep mathematics which have become very much a subject of the hour, as one of the first known examples of the "devil's staircase" type of anomaly in physics. It was this field that stimulated the mind of his best-known student, Douglas Hofstadter.

I have not begun to exhaust the number of deep, elegant and seminal mathematical insights, all springing from genuine roots in experimental physics, that grace Wannier's career. His output was relatively brief only because he disdained piecemeal publication and trivial results.

Wannier was born 30 December 1911 in Basel and received his PhD under Ernst Stueckelberg at the University of Basel in 1935. He retained a love for his city, for Switzerland, and for their history to the end of his life. An exchange fellowship at Princeton with Eugene Wigner in 1936 brought him to the US. After a year in Bristol in 1938–39, where he worked with Kramers and with Nevill Mott and his associates, he returned to the US for the war years. After academic jobs in Texas and Iowa and a brief stay at Socony-Vacuum Oil Company, he went on in 1949 to the Bell Telephone Laboratories, where he spent eleven of his most productive years (interrupted by a year's return to Geneva). In addition to his own work at Bell, he was a valued consultant to the physical-electronics experimentalists. In 1961 he went on to the University of Oregon, where he settled for the remainder of his life.

Wannier had a true sense for the really fundamental problems. I am indebted to him for the recognition of the experimental existence of the localization problem, in a little paper of 1949 called the "Band Structure of Insulators": what he called the "wiggly band" problem.

I remember Wannier with deep personal affection and gratitude for molding my early career in physics, when we were colleagues and friends at Bell. It was a great pleasure and honor to attend and speak at his very successful "70th birthday" (actually nearer his 71st) celebration at Eugene last spring, at which keynoted talks were delivered by his astrophysicist son Peter and by Douglas Hofstadter. Among other participants were Gerald Mahan, Marvin Cohen, and David Thouless, all of whom spoke on work stimulated by Wannier's ideas. The uniformly high intellectual level and the pleasant and informal atmosphere will remain a treasured memory.

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Alfred Kastler

Alfred Kastler, the eminent French physicist, died on 7 January 1984 at the age of 81.

Kastler was born 3 May 1902 in Guewiller, Alsace, then a part of Germany. He received his early education in Colmar, where he developed an interest in science and where his teachers helped him gain admission to the École Normale Supérieure. At the École Normale Kastler was introduced to quantum physics by his teacher Eugene Bloch, and he read with particular interest Arthur Sommerfeld's *Atombau und Spektrallinien*. He was particularly impressed by the principle of the conservation of angular momentum during interactions between electromagnetic radiation and atoms and by the new applications of this principle by A. Rubinowicz and Wilhelm Hanle to interpret experiments on resonant and Raman scattering of light by atoms and molecules. As a thesis topic Kastler chose to study the stepwise excitation of atomic states of the mercury atom, a phenomenon that stimulated much contemporary interest. The thesis was published in 1936. During the course of this work, Kastler states, he was struck by the fact that "the population obtained in the course of a stationary irradiation in the first excited state may become a non-negligible fraction of the population of the ground state, despite the weak intensity of the monochromatic light sources available at that time."

Kastler continued his work on atomic physics at the Ecole Normale during the German occupation of France, and he encouraged his first student, Jean Brossel, who had just completed a three-year stay in the laboratory of Samuel Tolansky in Manchester, England, to spend another year abroad at MIT with Francis Bitter, who wanted to find ways to extend I. I. Rabi's methods of radiofrequency spectroscopy to the study of excited atoms. Brossel and Bitter, with the guidance and advice of Kastler, soon carried out the first optical double-resonance experiment on mercury atoms. This new experimental method and variants of it were subsequently used in many laboratories to measure hyperfine structures of excited atomic states and to deduce many new nuclear quadrupole moments. The optical double-resonance method had two important advantages: It overcame the limitation that Doppler broadening imposed on the measurements' resolution, because radiofrequency and microwave fields were used to induce transitions between closely spaced energy levels; it also allowed one to use, as signals, changes in the polarization and direction of the easily detectable optical photons that were triggered by the much less energetic radiofrequency photons.

In 1950 Kastler published an important paper in which he showed that it was possible to transfer the angular momentum of circularly polarized resonance light to atoms in their ground states, an idea that was pursued independently at Princeton by Robert Dicke and his collaborators. Kastler received the Nobel prize in physics "for the discovery and development of optical methods for studying Hertzian resonances in atoms" in 1966.

Not the least of Kastler's achievements was the collection of a brilliant group of young scientists at the École Normale to exploit the fertile new experimental methods stimulated by his work. Always eager to help young scientists, he once wrote an article on the age of admission of candidates to the French Academy of Sciences: He pointed out that on the basis of his extrapolations of recent trends it was clear that only posthumous members would be admitted by the year 2000. He maintained a lifelong committment to his ideals of peace and social justice.

William Happer
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Kurt Symanzik

On 25 October 1983 Kurt Symanzik died in Hamburg, Germany, of cancer. In 1981 the German Physical Society had awarded him the Max Planck Medal, its highest honor, for his many fundamental contributions to quantum field theory and for the impulse he had given to the development of quantum chromodynamics (QCD), the currently accepted theory of strong interactions between elementary particles.

Symanzik was born on 21 November 1923 in Lyck and grew up in Königsberg (Germany, now in the USSR). He began his studies of physics in 1947, in Munich. He later became a student of Werner Heisenberg in Göttingen and received his PhD in 1954, with a thesis on the Schwinger functional in quantum field theory. He continued to work in Göttingen in collaboration with Harry Lehmann and Wolfhart Zimmermann. They formed the legendary "*Feldverein*," in the name given to them by Wolfgang Pauli. From 1955 until 1968, Symanzik worked in the US: at the Institute for Advanced Study in Princeton, at the University of Chicago, and, starting in 1962, as a professor of mathematical physics at the Courant Institute of New York University. In 1968 he returned to Germany, as a leading scientist at the Deutsches Elektronen-Synchrotron (DESY) in Hamburg.

SYMANZIK

One of the best known of Symanzik's many contributions to quantum field theory and elementary-particle physics resulted from his collaboration with Lehmann and Zimmermann in Göttingen. The LSZ formula, which is now in all the textbooks on elementary particle physics, expresses scattering cross sections, such as those measured at accelerator laboratories like DESY, in terms of quantum-mechanical expectation values of products of field operators.

While at the Courant Institute, Symanzik discovered that quantum field theory admitted a mathematical transformation into classical statistical mechanics. This discovery was basic for the rigorous mathematical construction of quantum field theoretical models and has become used in almost all the present numerical and analytical work on nonperturbative effects in quantum chromodynamics (confinement, masses of elementary particles). He also introduced random-walk representations, whose applications range from studies of quark confinement to localization properties of electron states in amorphous materials.