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OBITUARY

Kai Siegbahn (1918–2007)

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Kai Siegbahn in Uppsala, Sweden, 2001 (photograph by Magdolna Hargittai)

Kai Siegbahn was Professor Emeritus of Physics at Uppsala University, Sweden. He received one half of the 1981 Nobel Prize in Physics "for his contribution to the development of high-resolution electron spectroscopy." The other half was shared by Nicolaas Bloembergen and Arthur L. Schawlow "for their contribution to the development of laser spectroscopy."

Kai Siegbahn received his PhD at the University of Stockholm in 1944. He was a research associate at the Nobel Institute for Physics till 1951, Professor of Physics at the Royal Institute of Technology till 1954, both in Stockholm. In 1954 he became Professor of Physics at Uppsala University, and was, for many years, Head of the Physics Department, from where he retired officially in 1984 but continued to work to the end of his life.

I visited Dr. Siegbahn in his laboratory at the University of Uppsala in 2001. This was an unusual interview in that we did not sit down to talk; we were just walking around in the laboratory while Dr. Siegbahn was showing me the different physical experiments in the lab. He was 83-years-old at the time and full of energy and enthusiasm. They had just devised and built a new X-ray machine to take X-ray pictures of a person from four different angles. The data were then transferred by the computer into a three-dimensional picture that could be seen on the screen, rotating. He showed me different parts of a human body; I saw a hip, a skull, and a hand, from all directions, as they were rotating on the screen. They built everything themselves. Dr. Siegbahn noted that it was surprising that nobody had ever thought of doing this kind of imaging before—although, he admitted that to develop the technique to the stage when it could be applied in a routine manner, in a hospital, for example, would take a lot of money. They also worked out a holographic variant of the same machine. With this machine, they could take the picture, and then, select different parts of the body, for example, the heart, walk around it, and look at it from all directions. The holographic version required a very large computer and therefore building it that time was almost prohibitive—but as he remarked, it was just a question of time.

Siegbahn's major achievement, for which he eventually received the Nobel Prize, was the development of a special kind of electron spectroscopy, called ESCA (Electron Spectroscopy for Chemical Analysis). Electron spectroscopy is based on the photoelectric effect (Albert Einstein explained it in 1905 and received the 1921 Nobel Prize in Physics for it in 1922): if a monochromatic light irradiates

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a substance, the energy of the emitted electrons will be equal to the energy of the incoming light minus the energy with which the electron was bound to the sample. Based on this, measuring the energy of the emitted electrons, the electronic structure of the sample could be studied. However, as it turned out, it did not work, because the emitted electrons lose energy due to different collisions on their way out of the sample. Therefore, the method did not seem to be useful. It did not, that is, until Kai Siegbahn and his colleagues, Carl Nording and Evelyn Sokolowski, started to study photoelectrons with a high-resolution double-focusing spectrometer and eventually developed a method to measure the kinetic energies of the electrons coming out of the sample with sufficient accuracy. This is how ESCA was born. It has become a well-known and widely applied analytical technique due to its great sensitivity, and has been used for the analysis of both surfaces (semiconductors, catalysis, corrosion) and gases (for example, impurities in air samples).

It was natural for Kai Siegbahn to become a physicist. He was 6-years-old when his father, Manne Siegbahn (1886–1978), was awarded the Nobel Prize in Physics for 1924 (in 1925), "for his discoveries and research in the field of X-ray spectroscopy." To receive the Nobel Prize by a father and a son is quite special, although not unique; in the history of the Nobel Prizes it has happened six times. The first occasion was that of Sir William Bragg and Lawrence Bragg sharing the 1915 Nobel Prize for Physics; in all other cases several decades elapsed before the son, too, received the prize. In three cases both fathers and sons received the physics prize: beside the Siegbahns, J. J. Thomson (1906) and George P. Thomson (1937), and Niels Bohr (1922) and Age Bohr (1975). In the remaining two cases the chemistry and physiology or medicine prizes were awarded to fathers and sons: Karl A. S. Euler (Chemistry, 1929) and Ulf von Euler (Physiology or Medicine, 1970), and Arthur Kornberg (Physiology or Medicine, 1959) and Roger Kornberg (Chemistry, 2006).

During our meeting, Kai Siegbahn told me how he still remembered the ceremony of his father's prize; how he and his brother got new clothes and that the whole family went to the Music Academy, where the award was made by the King. Little Kai was very disappointed because the King did not wear a crown. His father liked to take him to the laboratory on Sundays, when he was about 10-years-old. The father used to project spectra on the wall; they were beautifully colorful and young Kai enjoyed them very much. As he told me: "I enjoyed them almost as much, not quite, but almost, as playing football." In his youth, he met many other famous physicists, who came to visit in Uppsala. Continuing in the family tradition, two of his sons have also become physicists.