Nikolai Albertovich Fuchs
31 July 1895 – 10 October 1982

Professor N.A. Fuchs, 1980, (Kitaev, oil on canvas)

Perhaps there is no aerosol physicist or chemist who does not know the name of Nicolai A. Fuchs and his book *The Mechanics of Aerosols*. Fuchs was the founder of aerosol science in Russia and an important co-founder of this scientific discipline worldwide. He belonged to that rare class of scientists who combine a brilliant experimental technique with the ability to create theoretical interpretation from experimental results. He was also an accomplished classical theoretical physicist.

Professor Nicolai Albertovich Fuchs was a member of Karpov Institute of Physical Chemistry, Moscow, until the time he died at the age of 87. Fuchs' recognition in the USSR came late. In 1970 he received the title of Honored Worker in Science and Technics and was awarded the Order of Red Banner.

Early Career

Nikolai Albertovich Fuchs was born 31 July 1895 in Lantvarovo, a small town in Lithuania, where his parents spent the summer. There were four boys and one girl in his family. He was the youngest of the boys. They took music lessons and learned French and German. Nikolai graduated from the Moscow Commercial Institute in 1917 and during the 1920s he had several different jobs. He worked as an engineer and at the same time continued playing the violin in the orchestra. He taught physics and chemistry in the Moscow Institute of Chemical Engineering. His scientific career began in the laboratory of the famous Russian physicist, P.N. Lebedev, at the supervision of Prof. P.P. Lazarev. His studies were devoted to the mechanics of colloidal particles. He started his independent scientific work in the Cathedra of Colloid Chemistry of Moscow Institute of Chemical Engineering. During this period of his life his work was devoted to investigation of the capillary equilibrium and interface between two liquid phases and a single vapor phase, to development of the method for investigating surfaces. He contributed significant experimental work on the nature of "two-dimensional crystals". Of considerable significance was his early paper discussing "linear adsorption".

In 1932 he was invited to work at Karpov Institute of Physical Chemistry in Moscow where he organized the first aerosol laboratory in Russia. He first investigated the "particle oscillating method" for measuring the size and charge of fine aerosol particles, to the mechanisms of aerosol formation, and to the theory of evaporational and condensational growth of fine droplets whose size is comparable with the mean free path of the molecules of the suspending gas.

Fuchs developed the method of "boundary sphere" for description of the transfer phenomenon in ultrafine aerosols. This work he did in the 1930s is now considered as classical work. In 1937 he and his co-workers developed the electrohydrodynamic method of fine polymer fibrous filter production.

In 1937 N.A. Fuchs wrote his D. Sci. Dissertation Thesis and planned to receive his D. Sci. Degree scheduled for April 24. But on April 22, he was arrested.

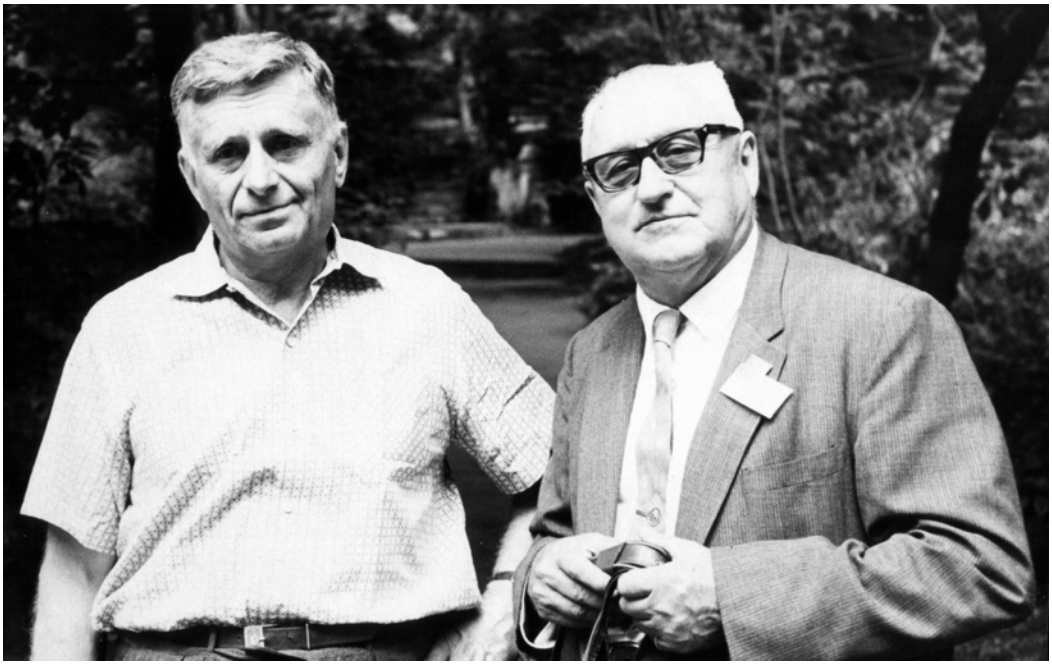
Mid -career

Initially, Fuchs was taken to prison in Moscow. He had been given "5 years of camp" and was sent to work in the coal mines in the North, of course without a trial. After several months, he was brought back to Moscow and was put to work in a secret chemical laboratory of the special prison (remember the book of A.I. Solzhenitzin, *The First Circle*). On 26 October 1945, he was released from prison, but he had no official permission to stay in Moscow. He got a job at a secret institute some 70 km from Moscow. Later in 1946, he got a job in the Institute of Fungicides, where he conducted research on surface chemistry. In 1947 he was granted his doctorate and began work on *The Mechanics of Aerosols*.

Fuchs was among the first in 1948 to introduce gas chromatography into Russia. At the same time he worked on aerosol science. In 1951 hard times began once more for him. He had to leave Moscow again. Prof. Fuchs was appointed Acting Head of the Department of Physics at the Stavropol Agricultural Institute. After Stalin’s death, in April 1953, Fuchs received an amnesty. He worked at the Institute of Disinfection in Moscow, then at the Institute of Scientific and Technical Information as Head of the Department of Analytical Chemistry.

In 1955 his monograph *Aerosol Mechanics* was published in the USSR. It is still one of the most important books and is considered the handbook for aerosol researchers. Later, his monographs *Evaporation and Droplet Growth in Gaseous Media* and *Progress in the Mechanics of Aerosols* appeared in the USSR.

An English edition of *The Mechanics of Aerosols* was prepared by C.N. Davis and published by Pergamon Press in 1964. The second English edition of *The Mechanics of Aerosols* appeared in 1989, published by Dover Publishers, at initiative of the AAAR.



Profs. N.A. Fuchs and V. La Mer, 1964, Karpov Institute, Moscow

Mature Years

In 1959 Fuchs was permitted to work at the Karpov Institute. He organized a new laboratory for studying the physics of aerodisperse systems. In the 60s, his work was primarily devoted to investigation of the formation of condensation aerosols, the theory of aerosol filtration, and the study of the dispersion of dust. During this period, Fuchs and his young co-workers published a series of papers on the diffusion method of ultrafine particle size distribution measurements, generation of monodisperse particles, and investigation of aerosol properties. The experimental efforts of Fuchs and colleagues to verify their filtration theory gave the most significant results in this field.

He wrote a number of reviews on the development of aerosol science. In 1971 he published the first part of a *Collection of Aerosol Abstracts* covering literature published up to 1953, a valuable document for historical research. The whole collection covers 22,000 abstracts.

Fuchs was a leader of the Moscow Aerosol Colloquium. He was a member of the editorial boards of *Colloid Journal* (in Russian), of *Journal of Aerosol Science* (beginning 1970), and of *Annals of Occupational Hygiene* (beginning in 1963).

Fuchs' scientific contribution has been acknowledged by many. In the mid-1980s, aerosol societies of the USA (AAAR), Germany (GAeF), and Japan (JAAST) decided to create the Fuchs Memorial Award in Aerosol Science. Once every four years, this award is presented at the International Aerosol Conference to respected and internationally recognized aerosol scientists. Moreover, Fraunhofer Institute for Toxicology and Aerosol Research is located on Nikolai Fuchs Strasse in the German town of Hannover.

References

Fuchs Nikolai A. (1955) *МЕХАНИКА АЭРОЗОЛЕЙ* (*Mechanics of aerosols*, original Russian edition), Academy of Sciences of the USSR, Moscow, 352pp.

Fuks N.A. (1958) *The Mechanics of Aerosols*, (first English translation from the Russian by E. Lachowicz) CWL Special Publication 4-12, U.S. Army Chemical Warfare Laboratories, Army Chemical Center, Maryland, 461pp.

Fuchs Nikolai A. (1958) *Evaporation and droplet growth in gaseous media* (original Russian edition), Akademizdat, Moscow. English edition: (1959) Pergamon Press, Oxford.

Fuchs Nikolai A. (1961) *Progress in the mechanics of aerosols*, Akademizdat, Moscow.

Fuchs Nikolai A. (1964) *The mechanics of aerosols*, revised and enlarged edition, (translated from the Russian by R.E. Daisley and Marina Fuchs, translation edited by C.N. Davies), Pergamon Press, Oxford, England, and The Macmillan Company, New York, 422pp.

Fuchs Nikolai A., editor (1971) *Collection of aerosol abstracts, Volume I covering literature published before 1953*, Karpov-Institute of Physical Chemistry, All-Union Institute of Technical and Scientific Information, Moscow, 22,000 abstracts.

Fuchs Nikolai A. (1989) *The mechanics of aerosols* (republication without retypesetting of the original 1964 Pergamon edition), Dover Publications, New York, 424pp

Kirsch A.A. (1999) Nikolai Albertovich Fuchs, 1895-1982, *Russian Chemical Journal (Journal of the Mendeleev Russian Chemical Society)*, 43(2):108-111 (a biography, in Russian).

Solzhenitsyn Aleksandr .I. (1968) *The First Circle*, Harper & Row, New York.

Biography prepared by
Alexander and Vasily Kirsch

(Editor's note: One may learn more about the life of Fuchs in: K.R. Spurny and J.C.M Mariunissen,editors (1998) *Nicolai Albertowich Fuchs – The Pioneer of Aerosol Science – Biography*, Delft University Press, Delft, Netherlands, 82pp.)