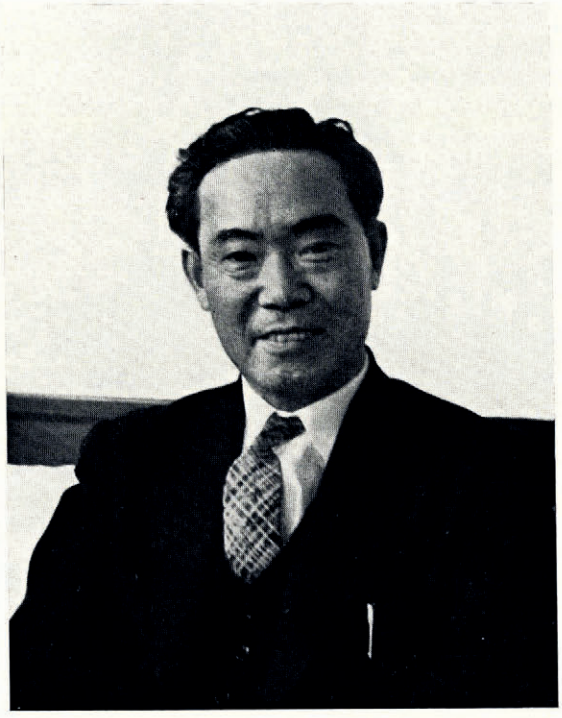
# OBITUARY



UKICHIRO NAKAYA—1900–1962

Professor Nakaya was born at Katayamazu (Japan) on 4 July 1900. He graduated at the University of Tokyo in 1925, and became a research assistant at the Institute of Physical and Chemical Research until 1928 when he went to King's College, London. On his return to Japan in 1930, he was appointed an Assistant Professor at the University of Hokkaido, being promoted to Professor of Physics there in 1932.

Although Ukichiro Nakaya carried out some research work in atomic physics on subjects such as spark discharge and soft X-rays early in his career, the main subjects of his investigations were snow and other physical phenomena which occur in a cold environment.

His investigation of natural snow crystals began in 1933 directly after he was appointed Professor of Physics in the University of Hokkaido, where the department of physics was organized in 1930 by himself and other staff members. He used to say that the first interest that made him begin his study of snow came from the beauty of snow crystals falling every day in winter in this northern part of Japan.

After having investigated natural snow crystals in respect of classification, falling velocity, size distribution and electrical properties, he ventured on an attempt to make snow crystals artificially. In 1935 the University provided a small cold room laboratory for his researches. In this laboratory he and his collaborators patiently carried out many experiments for making artificial snow crystals. By 1940 he could make almost all types of snow crystals in his special apparatus with the adjustment of temperature and humidity of air in which the crystals grew. The so-called Nakaya diagram which set out criteria of conditions for making various kinds of snow crystals in regard to temperature and humidity (supersaturation) still serves as a standard

basis for discussions of snow crystal growth. In 1940 he was awarded an Imperial Academy Prize for his researches.

Inspecting forms of fallen snow crystals with the help of Nakaya's diagram, we can presume meteorological conditions in clouds from which the crystals fell at that time. This is the reason for his famous phrase, "A snow crystal is a letter from high up in the sky". The small cold room laboratory expanded to the Institute of Low Temperature Science at the University during the war; Professor Nakaya helped many investigators both inside and outside the Institute with their research work on such subjects as icing on aircraft, frost heaving and prevention of fog.

For several years, despite the economic difficulties of Japan after the war, he was enthusiastic in conducting such research projects in applied physics as the acceleration of melting of the snow cover, raising of water temperature in rice paddies, investigation of floods and snow surveying. Through these researches he contributed much to the better understanding of the efficient use of water resources in Japan. However, he did not neglect his main interest in snow crystals. A film "Snow crystals" which was presented at the ninth General Assembly of the International Union of Geodesy and Geophysics in Oslo in 1948 won much praise from those who saw it, even though he could not be at the conference at that time. He conducted an electron microscope study of the nuclei of snow crystals and this marked an epoch in the development of cloud physics. A voluminous book, *Snow crystals*, in which he assembled his investigations up to 1950 of snow crystals both natural or artificial, with many beautiful photographs, was published by the Harvard University Press in 1954.

In 1949 he paid a visit to Canada and the United States, which shaped the course of his life in his fifties. After having attended a special meeting for the international classification of snow crystals in Canada, he went to the United States and was consulted about a plan to establish a new research institute for the study of cold environments. The institute was founded as the Snow, Ice and Permafrost Research Establishment, U.S. Army, in Wilmette, Illinois (now Cold Regions Research and Engineering Laboratory, Hanover, N.H.). He accepted an invitation and stayed there as a contract scientist for two years from 1952 to 1954 on leave from the University. During this period at SIPRE, he began a new type of research on the physical properties of single crystals of ice. He elucidated the mechanism of growth and thermal behaviour of Tyndall figures (negative crystals) in ice crystals with his ingenious experiments. Also in this period he compiled many data on plastic deformation of ice crystals which made it clear that the ice crystal slips in the basal plane in layers. Although Part I of his geometrical analysis of deformation was published after he came back to Japan, his mechanical interpretation has never been completed.

One reason which made it impossible for him to find time to complete this report on the mechanism of deformation of ice crystals was that he was carrying out field work on snow crystals and also on deposited snow on the Greenland Ice Sheet. In the winter of 1956 he went to the top of Mauna Loa in Hawaii for observations of snow crystals grown in very clear air. This was related to his laboratory experiments on artificial snow crystals which aimed to see the effects of nuclei existing in the air. From 1957 to 1960 he spent every summer on the Greenland Ice Sheet with SIPRE expeditions. He had great success in the investigation of visco-elastic properties of snow and ice which were cored down to more than 3,000 feet (915 m.).

In 1957 he was elected a Vice-President of the International Commission on Snow and Ice at the I.U.G.G. conference in Toronto, Canada. In 1958 he travelled to Europe and attended the conference on ice movement held at Chamonix, France. He was also an active organizer of the International Conference of Cloud Physics at Woods Hole, U.S.A., in 1959. It can be said that his activity was truly international. An excellent research worker, he also excelled in teaching physics in the University. His lectures on electromagnetism and general

physics left very clear impressions in the minds of his students. He was always a kind and considerate teacher. He inspired his students to work with care.

Besides his great activity in research and teaching, his talent was also displayed in his essays on science and thought. These attracted and enlightened many people by their deep insight into science and humanity. Published volumes of his essays number more than twenty.

When he came back from Greenland in the autumn of 1960 illness overtook him, which eventually led to his death on 11 April 1962. He is survived by his wife and three daughters.

AKIRA HIGASHI

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