

THE DISCOVERY OF NUCLEAR FISSION

WOMEN SCIENTISTS IN HIGHLIGHT



NHU-TARNAWSKA HOA KIM-NGAN
AND
IMRE PÁZSIT

Göteborg, 2007

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The Discovery of Nuclear Fission - Women Scientists in Highlight

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Front cover photos:

Ida Tacke-Noddack

Irène Joliot-Curie

Lise Meitner

Back cover picture:

The skiing promenade of Lise Meitner and Otto Frisch (in Kungälv, Sweden) at Christmas 1938 when the idea of nuclear fission was born. (Drawing by Maria Pázsit, inspired by an arranged film of Jan-Olov Nilsson, Swedish Television, 2002).

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Preface

This textbook was written primarily for those wishing to get a deeper knowledge and understanding of the history of nuclear physics in its early stages, in particular one of the most remarkable phenomena in nuclear physics: the nuclear fission. Nuclear fission was one of the most important discoveries of the 20th century. It had far-reaching effects on world science and politics and led to a major change of thinking about nuclear reactions and their application, as well as nuclear weapons.

This book concerns the remarkable contributions of three women scientists with respect to the discovery of nuclear fission: Ida Tacke-Noddack, Irène Joliot-Curie and Lise Meitner. Ida Tacke-Noddack was the first to suggest some isotopes of known elements, observed after irradiation of uranium with neutrons, as fission products (in September 1934). Irène Joliot-Curie discovered lanthanum (a radioactive element with 3.5 hour half-life) as a fission product (in late 1937), which opened the way to the discovery of nuclear fission. Lise Meitner (together with Otto Frisch) gave the first interpretation of the fission of uranium and predicted the massive release of energy with an estimated value of 200 MeV (in December 1938/January 1939).

The first part of the book highlights the following events: 1) Ernest Rutherford with achieving the first nuclear reaction (in 1919) and his disbelief in a large scale production of energy by nuclear reactions; 2) Leó Szilárd with his patent of the chain reaction via neutrons (in 1934); 3) Enrico Fermi with the first fission experiments by slow neutrons (in 1934) and his conclusion that uranium splitting could not occur; 4) Otto Hahn with the discovery of barium from uranium fission (in December 1938); and 5) the significant role of the three women scientists in the discovery of nuclear fission: Ida Tacke-Noddack, Irène Joliot-Curie and Lise Meitner. Included in the book is recalling of the historical events from the famous scientists and especially the exchange of letters between Otto Hahn and Lise Meitner related to the discovery of uranium fission. An introduction to the nuclear reaction and nuclear fission, given in the supplements, provides some more physical insight to such processes. The second part of the book contains the biographies of the scientists who contributed to the discovery of nuclear fission: their lives and achievements.

The main sources of information are the following: CWP archive “*Contributions of 20th century Women to Physics*”- University of California and Ruth Lewin Sime’s book “*Lise Meitner - A life in Physics*”, Berkeley-University of California Press, 1996.

This textbook should be suitable as teaching material in courses and lectures concerning the history of modern physics.

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Professor Nhu-Tarnawska Hoa Kim Ngan is working at the Institute of Physics, Pedagogical University of Krakow, Poland. She got her PhD at the University of Amsterdam in 1993, and habilitation at the AGH University of Science and Technology in Krakow in 2005. Her main research interests are materials science and surface physics. (Her abbreviation used in the scientific work: *N.-T. H. Kim-Ngan*).

The work in history of physics, in particular the contributions of the women scientists, is partly related to her teaching, especially in motivating the young female students in her institute.

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