

# Bookshelf

COMPILED BY VIRGINIA GRECO, CERN

## Half Life: The Divided Life of Bruno Pontecorvo, Physicist or Spy

By Frank Close

**Oneworld**

Also available at the CERN bookshop

In this book, Frank Close tells the story of the enigmatic life of renowned Italian physicist Bruno Pontecorvo, reporting plenty of historical details about his work and personal affairs. The reader is taken on a fascinating story, which develops in difficult times – the years just before, during and after World War Two.

Following an introduction about Pontecorvo's early life, the story continues with a discussion of the discovery of neutron moderation in 1934 and the role played by Pontecorvo, along with its scientific and political consequences. The author gives many insights that will amaze physicist readers.

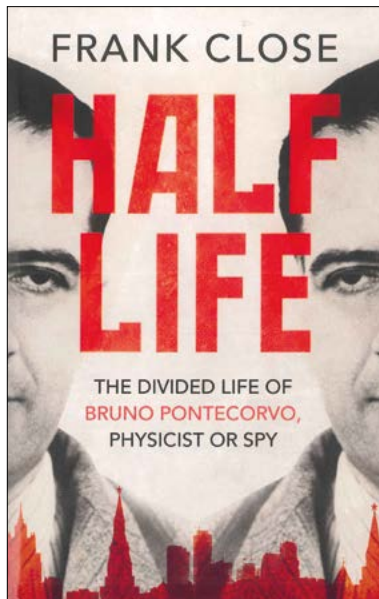
After this discovery, Pontecorvo begins his career as an international scientist. He moves to France in 1936, where he works with Frederic Joliot-Curie and meets Marianne Nordblom, his future wife. In 1938, Marianne and Bruno have their first son, Gil.

The events of the life and work of Pontecorvo are embedded in an incredible historical background. As an example, in March 1940, about 40 gallons of heavy water are shipped from Norway and hidden from Nazis in France. This precious treasure would later be taken to the UK by two scientists who were working with Pontecorvo. The heavy water is clearly related to the attempt to use and control nuclear fission.

In Paris, Pontecorvo joins the Communist Party. His political ideas will play a crucial role in his personal and professional life. When the Nazis invade France, Pontecorvo has to move away. Helped by his friend and colleague Emilio Segré, in 1940 he and his family set off for the US and settle in Tulsa, Oklahoma.

In November 1942 he meets again his mentor, Enrico Fermi, who was interested – together with his collaborators – in the activities of Pontecorvo, and in particular in an instrument he designed to search for oil underground by detecting neutrons. As a consequence of this event, Pontecorvo gets the opportunity to move to Canada and join the Anglo-Canadian reactor project at Montreal, aimed at making a reactor based on uranium and heavy water.

In January 1943, Pontecorvo sets off for his new job, which he will hold for seven years. In Canada, he joins an active team made of some 100 scientists and engineers.



At this time, the FBI sends three letters to the British Security Coordination Office in Washington because of concerns about the physicist's communist sympathies. A number of interesting details and anecdotes are given by Close about this and other related events.

For security reasons, the Anglo-Canadian project is carried out at Chalk River, which then becomes a target for Soviet agents. The author provides fascinating insights about the spy network, collecting information on the nuclear programme in the years after the end of World War Two. Nunn May, a collaborator on the project, is arrested in 1946 for espionage.

During his years at Chalk River, Pontecorvo also becomes interested in neutrinos and carries out important studies.

He joins the Atomic Energy Research Establishment in Harwell, UK, in January 1949. Although offered a number of positions in the US, he prefers to move to the UK. One month later, another colleague, Klaus Fuchs, is arrested for espionage. This is a difficult time for Pontecorvo, whose movements are followed by Military Intelligence. Close probes into events in Pontecorvo's life during these years, to give the reader an idea of the role that he plays. He tells the story of the Soviet agent Lona Cohen, as well as of Kim Philby, another agent who might have had an important impact on Pontecorvo's decision

to escape to the Soviet Union at the end of the summer of 1950. The reader can try to solve the Pontecorvo enigma on the basis of the information reported – did he give information about the reactor commissioned in 1947 to the Soviet Union?

The life of Pontecorvo and his family in the Soviet Union is also described, detailing the problems they faced settling yet again into a new country, after France, the US, Canada and the UK. Many other interesting aspects of his life are discussed, including the events following 4 March 1955 when the physicist was interviewed in Moscow after five years of silence, and the happenings at an international meeting on high-energy physics that he attended in Kiev in 1959.

Close also reports on an interview with Pontecorvo by Italian journalist and writer Miriam Mafai, which gives a profound insight into his mysterious life. In my opinion, the book is very much worth reading and the amount of detail is impressive. The publication of this wonderful book is already stimulating discussions among physicists and will reawaken interest in the Pontecorvo enigma.

● Aldo Ianni, *Canfranc Underground Laboratory, Spain.*

## Inside CERN's Large Hadron Collider: From the Proton to the Higgs Boson

By Mario Campanelli

**World Scientific**

Also available at the CERN bookshop

In this concise book, Mario Campanelli provides an overview of particle-physics research at CERN. He starts with an introduction about the history of this branch of science, tracing the steps of its evolution through speculative theories and experimental proofs, up to the completion of the Standard Model puzzle with the discovery of the Higgs boson in 2012. It is hard to condense – and explain in relatively simple terms – all of this complex material. As a consequence, the first section of the book should be considered by particle-physicist readers as a brief summary of known concepts, while by non-experts in the field as a very quick overview of the basics of particle physics.

The following chapters focus on CERN, home to the Large Hadron Collider (LHC). After a short account of the history of the laboratory concerning the different accelerators and relative detectors that followed one another, the author discusses the challenges that scientists had to face to design, construct and



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commission the LHC – a giant, complex and technologically advanced apparatus. He explains how the machine works, from the superconducting magnets to the acceleration phases (realised consecutively in different pre-accelerators and, finally, in the collider) and the beam extraction, showing that the LHC is a marvel of engineering. No less important, of course, are the detectors, which are necessary to study the products of collisions for different research purposes. A chapter is then dedicated to describing the experimental apparatus of the four main experiments: ATLAS, CMS, ALICE and LHCb.

The reader is also given an idea of how data are selected, stored and analysed to extract interesting information, as well as of the physics topics that are investigated by these experiments, including the Standard Model (SM), quantum chromodynamics, b-quark and top-quark physics, supersymmetry and any sign of new physics. The latter is what physicists working at CERN are really eager to find – particles or phenomena that could enable theorists to go beyond the SM. A chapter is dedicated to the discovery of the Higgs boson – the most important result accomplished with the LHC up to now.

Since such a great endeavour cannot be realised without hard work, professionalism and collaboration, the author highlights the importance of the human factor in such a varied, multicultural and highly competitive environment. Finally, a few paragraphs on the impact of high-energy physics research on industry and society conclude the book.

Written in a fluid style, this book would appeal to those who, even if not completely unfamiliar with the topic, know little about collider physics, CERN and its experiments.

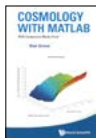
● Virginia Greco, CERN.

## Books received

### Cosmology with MATLAB

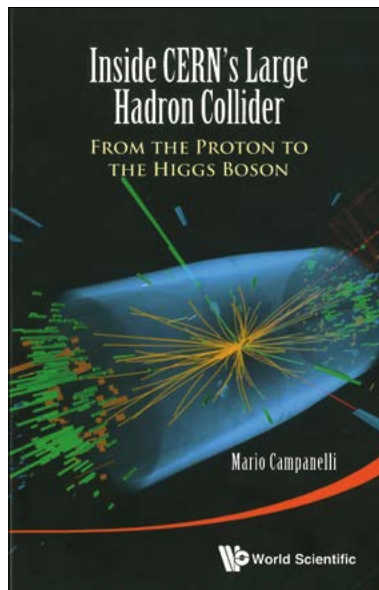
By Dan Green

World Scientific



The aim of this book is to show how software packages such as MATLAB can be extremely useful for studying cosmology problems by means of complex simulations. Thanks to the greatly improved accuracy of cosmological data and the increased computing power available, the calculation and graphic tools offered by this software can be profitably employed to study physics problems and compare different models.

A theory that successfully describes the universe and its evolution in terms of only six



fundamental parameters has been developed.

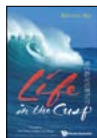
It accounts for the Big Bang (BB), cosmic microwave background (CMB) radiation and the evolution of matter to the present day. However, the model cannot explain some experimental results. The inflation hypothesis, which postulates the existence of a scalar field that caused an exponential expansion of the very early universe, can solve some of these open problems.

This book provides a basic exposition of BB cosmology and the inflationary model using MATLAB tools for visualisation and to develop the reader's understanding of the parametric dependence of the observables. Different models are compared, including one that assumes the Higgs field as the scalar inflationary field. In this way, readers can gain experience in using various MATLAB tools (including symbolic mathematics, numerical-solution methods and plots) and also apply them to other problems.

### Life on the Cusp

By Weimin Wu

World Scientific



The extraordinary scientific career and personal life of the Chinese-naturalised American physicist Weimin Wu have played out against the backdrop of profound political and cultural changes in China during the last 70 years.

In this autobiography, Wu describes the diverse and colourful events of his life and sketches a portrait of the social

environment where they took place. He was personally involved in the making of the first atomic bomb in China, aged just 17, and he participated in the analysis of the data collected by the first artificial Chinese satellite, as well as in the construction of the first electron-positron collider. An e-mail that he sent from Beijing to Switzerland in 1986 is considered to be the first in the history of the internet in China. He was also a member of the research team that observed the first  $J/\psi$  particle in Beijing, and of the CMS experiment, where he worked on the search for the Higgs boson.

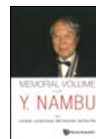
Not only has he had a remarkable career, his personal life has also been marked by many unusual and stormy events. He had a poor childhood, undertook various jobs as a labourer or a farmer, and was forced to emigrate to the US after becoming personally involved in the Tiananmen Square protest.

The author tells the story of his scientific trajectory and life “on the cusp” with a candid spirit, describing both the events and his inner feelings – details of his emotional experience and love stories add to the book.

### Memorial Volume for Y Nambu

By Lars Brink, Lay Nam Chang, Moo-Young Han and Kok Khoo Phua (eds)

World Scientific



Less than a year after his death at the age of 94, World Scientific has published a book honouring the memory of Yoichiro Nambu, who was one of the greatest physicists of the second half of the 20th century. A brilliant mind and a visionary thinker, Nambu contributed to the development of many areas of theory – from particle to condensed-matter physics.

In the 1960s, he introduced the concept of spontaneously broken symmetries (with G Jona-Lasinio) and identified a new symmetry for quarks and gluons (with M-Y Han). Both works can be considered cornerstones of the Standard Model of particles and forces.

This book provides an interesting collection of articles written by Nambu's former collaborators, colleagues, students and friends. Through these contributions, the reader can gain an idea of the importance and variety of Nambu's work, as well as learn about his personality. He is described by many of those who knew him as kind, warm and humble. Besides being very clever and “many years ahead”, he was also a good mentor. The volume concludes with the last scientific writing by Nambu himself, discussing the origin and development of particle physics.