

**Quantum Generations: A History of Physics in the Twentieth Century.** Helge Kragh. Universities Press (India) Ltd, 3-5-819 Hyderguda, Hyderabad 500 029. 2001. 494 pp. Price: Rs 450.

It is an indisputable fact that the twentieth century is characteristic of some phenomenal developments in physics related to both microcosmos and macrocosmos. Curiously enough, during the last decade of the nineteenth century the success of Newtonian mechanics and Maxwell's electromagnetic theory had prompted some physicists to believe that all the basic principles of physics were already known, apart from details. This picture changed drastically when unexpected experimental discoveries like the spectrum of black-body radiation, X-rays, electrons and radioactivity took place during the mid-1890s. These discoveries which represent qualitatively new phenomena opened new windows for studying further the secrets of nature.

Planck's hypothesis of the quantum of action in 1900 to explain the observed spectrum of black-body radiation led to the formulation of quantum mechanics which has proven to be the most successful theory ever. It was able to explain the entire atomic and subatomic structures and the forces that keep the basic particles together. Einstein's theory of special relativity in 1905 changed our picture of space and time entirely. The subsequent development of the general theory of relativity by Einstein accounted for the origin of the gravitational force as arising from the curvature of space.

The twentieth century is also characterized by the impact of physics on other areas of science, including life sciences and medicine. This made physics more applied in a certain sense. A notable example of this is provided by the structure of the DNA molecule in biology which was determined by Crick using the X-ray diffraction technique. The overall pace and direction of all sciences in the twentieth century has been largely influenced by the developments in both experimental and theoretical physics. This has established the unlimited and universal validity of the basic laws of physics. Also physics has become multidisciplinary.

By the end of the twentieth century, physics had been specialized in terms of several disciplines, like atomic and molecular physics, nuclear physics, semi-conductor physics, plasma physics, quantum optics, quantum electronics, quantum electrodynamics, thermodynamics and statistical physics, astrophysics and cosmology, high energy physics (particle physics), condensed matter physics, and biophysics.

The other remarkable aspect of the twentieth century involved the impact of social, economic and political factors on the development of physics. In fact, the development of physics was naturally affected by the two world wars. In particular, after the Second World War, physics experienced a considerable shift in terms of manpower, organization, finance, instruments and political and military values. The cognitive content of physics, however, does not depend significantly on the socio-cultural environment. Also the methodology of research has basically remained the same, apart from computer experiments. There have been several attempts in achieving a unified theory of all fundamental forces, viz. the electromagnetic force, the weak interaction force that is responsible for the decay of elementary particles and the gravitational force. So far, only the theory establishing the unification of electric and weak forces, the so-called electroweak theory has been successfully formulated and several attempts towards the formulation of the grand unification theory (GUT) are in progress. It is, of course, our everyday experience that the inventions in physics have also transformed our daily lives, prompting a technological revolution that includes the development of radio, television, lasers, computers and nuclear power.

In the book under review, Helge Kragh presents a comprehensive account of these extraordinary achievements in the area of physics of the twentieth century. The book is appropriately divided in four parts. The first three parts cover the developments in physics in a chronological order. Part one gives a masterly historical account of all the developments during the period from 1890 to 1918, the end of the First World War. This part covers the great discoveries in the mid-

1890s and other details which led to Planck's quantum hypothesis in 1900 and Einstein's relativity theory. Part two covers nicely an account of developments in physics and its fallout from 1918 to 1945 representing the period between the two world wars. It was during this period that nuclear fission was discovered and its applications towards realizing both nuclear energy for peaceful uses and the atomic bomb for military uses were developed. Part three describes the overall developments in physics and its specialization in various disciplines along with their applications. Part four gives a rather readable account of the physics of the twentieth century in retrospect, highlighting the list of all Nobel Prizes in Physics and Chemistry awarded to physicists. The Appendix specifies chapter-wise references for further reading listed in detail in the extensive bibliography added at the end of the book.

The twenty-nine chapters of this rather readable book cover a broad spectrum of physics, not only with respect to the topics presented and various disciplines discussed, but also with respect to the overall scope and applications of physics. Apart from discussing the purely scientific aspects related to fundamental physics with great clarity, Kragh has also emphasized the applied side of physical sciences leading to the technology in the twentieth century.

The progress in physics is often governed by the isms and paradigms prevailing at different times. These have been discussed well in this book. This makes the book rather useful to both students and teachers of modern physics. Because of the remarkable presentation of the background and the history and technical details of the developments in physics and their applications over the past hundred years, this book is of interest to non-specialists as well. Finally, the publishers, deserve to be complimented for reprinting this remarkable book so that it is available to readers in India at a reasonable price.

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