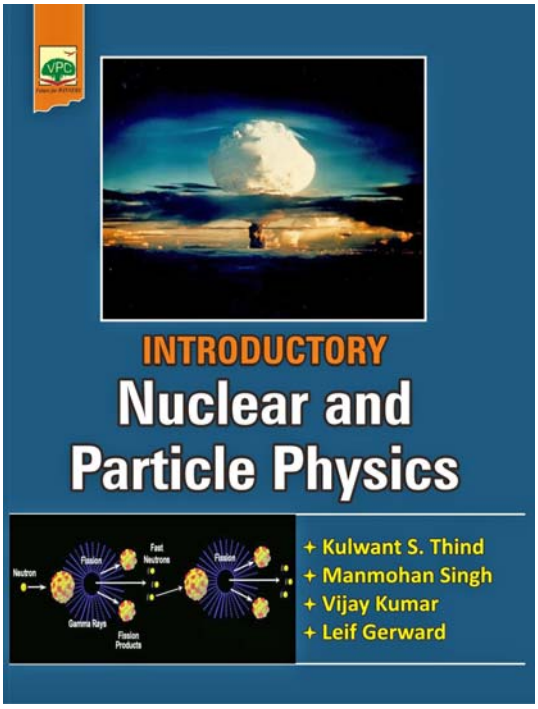

INTRODUCTORY NUCLEAR AND PARTICLE PHYSICS by Kulwant S Thind, Manmohan Singh, Vijay Kumar and Leif Gerward, Published by Vishal Publishing Co., Jalandhar, India, Paperback binding, Pages: 400, Price: Rs. 325/335 (India) / 700 (International).

Modern Nuclear Physics has become a mature subject and therefore, it is enriched with both theoretical insight into the intricate details of the atomic nuclei, their interactions with other nuclei and related numerous experiments to corroborate the theoretical models and their outcome into a solid foundation. Physics of the subject focuses on attempts at explaining the underlying nuclear phenomena spanning across the energy scales from kilo electron Volts (keV), which is the energy scale of average kinetic energy of the particles which burn as fuel of nuclear fusion inside the core of the sun or any star, to Giga electron Volts (GeV), which is the scale of energy of the quarks and gluons forming a new phase of matter called the quark gluon plasma (QGP). At intermediate energy scales around 100s of MeV, the same quarks, through the mediating gluonic field, constitute the nucleons which form a nucleus. At the same token, the involvement of a very important tool, in fact a work-horse of Nuclear Physics, the Accelerator, capable of delivering beams at different energies, finds its extensive use in experimental endeavours of Nuclear Physics in a top-down approach. Modern-day Nuclear Physics research is aimed at understanding the matter composed of quarks and gluons which make up 99% of the mass of the Universe, through their interactions governed by Quantum Chromodynamics (QCD). Most of this matter is found at the core of atoms, the same atoms that comprise all we see around us, including ourselves. Researchers seek to answer questions such as how the universe evolved just after the Big Bang from a super-hot and dense plasma of quarks and gluons, how the different elements of the universe were formed with varying abundances, how a nucleus is made up of individual protons and neutrons interacting with each other with the strongest force in Nature.

In the present scenario of Nuclear Physics, the book titled “Introductory Nuclear and Particle Physics” by Kulwant S Thind, Manmohan Singh, Vijay Kumar and Leif Gerward is a welcome addition to the class of books which may be called text books for a foundation course in Nuclear and Particle Physics for the undergraduate curriculum of lndian Universities. The major part of the book deals with Nuclear Physics starting from general properties of nuclei, nuclear models, radioactivity and nuclear decay processes and nuclear reactions. It is worthwhile to mention here that the prologue of the book contains syllabi of a few Indian Universities. The contents of the chapters more or less follow the course guidelines. The sections contain brief and to the point discussions on the relevant topics and the concepts. Detailed derivations of the underlying theory and equations are worked out in the book. This will help the theoretically inclined readers in working out the equations and in solving problems relevant to the respective chapters. A few selected problems and short answers are given at the end of each chapter.

Particle Physics part of the book contains introduction to the elementary particles. Bridging the gap in between Nuclear Physics and Particle Physics is done cleverly through introduction of two important chapters, viz. radiation detectors and accelerators. Both the chapters are relevant for the two major disciplines of Physics. In my opinion, the particle physics part of the book should have been more elaborate and at least should have included discussions on the 4 standard interactions and their role in the reactions and decay of elementary particles. The chapter on radiation detectors gives a good review of the working principles of different detectors and their utility. A few advanced particle and radiation detectors, such as Ring Imaging Cherenkov (RICh) detector, gaseous scintillators and Hyper Pure Germanium (HPGe) detectors are briefly introduced. However, a few popular detectors, such as Silicon detectors, gaseous drift chambers, time projection

chambers, etc. and their various configurations, which are used in nuclear and high energy physics experiments, such as charged particle identifier, tracking detector, calorimeter, etc. should have been briefly discussed in this chapter. This will give the idea of how to relate and utilize the signals obtained from different detectors in extracting the parameters, such as charged particle ID, mass, vector momenta, etc. Working principles of accelerators and colliders, starting from Cockcroft - Walton generator to Fermilab Tevatron are introduced in the chapter on Accelerators. While the accelerators are introduced as machines to boost the kinetic energy of charged particles, the important utilities of modern accelerators should have been introduced. For example, cyclotrons are used for producing medically important radioisotopes for treatment (eg. tissue irradiation of cancer patients) and diagnosis (eg. positron emission tomography). Electron synchrotrons, linacs and their modern variants produce intense, and in special cases, coherent photons (visible, UV, VUV and X-rays) which are very important and to some extent unique sources of photons produced by synchrotron radiation and used in various studies of properties in condensed matter physics, material science, biology and other interdisciplinary areas. Though discussion on synchrotron is included as proton accelerator, additional usages mentioned above and relevant modifications of the machine should have added value to the book.

Many pioneering experiments in Nuclear and Particle Physics have enriched the subjects dealt with in this book and based them on a solid foundation. Unfortunately, the book does not include discussion or reference to many such experiments. It also lacks directions for further reading which would motivate the young minds to delve deeper into the subjects and develop motivation for further higher studies in Nuclear and Particle Physics. Though the book includes bibliography at the end, citation of references in proper places, and chapter-wise list of references should have been included in the book. I am sure the authors will take care of the suggested modifications in future. Overall, the book is well-written with sufficient worked out details which will benefit the students to prepare themselves as per the University curricula. ❐

Professor Satyajit Saha
Senior Professor and Head
Applied Nuclear Physics Division
Saha Institute of Nuclear Physics
1/AF Bidhannagar, Kolkata 700 064