New Delhi was considered as its location.

The naturalist PM was concerned with all wildlife, not just glamorous tigers and lions. In 1975, Indira Gandhi launched Project Crocodile, this time at the urging of a Scottish biologist, Robert Bustard, who had been working in Australia. Bustard had also discovered the mass nesting grounds of olive ridley turtles in Gahirmatha in Odisha, which would reappear later in her life.

Following a brief account of her time 'out of office', Ramesh turns to her second stint as the 'Naturalist Prime Minister (1980–1984)'. At the very outset, she had to deal with issues surrounding big dams in Tehri and Silent Valley. The protests over these were to become iconic. Despite having a different party than her own in power in Kerala, she worked hard to convince the state that Silent Valley needed to be protected. Her efforts and those of all the national and international conservationists eventually ensured that it would be. Similarly, she succeeded in stalling work on the Tehri Dam, but it eventually went forward despite the efforts of the activist Sunderlal Bahuguna and others.

During this term, Indira Gandhi also passed the Forest Conservation Act, and discussions were initiated on a coastal regulation zone for the protection of coasts. In 1982, the issue of olive ridley turtles in Odisha was brought to her notice. Thousands of turtles were being caught in offshore waters and shipped to the markets in Kolkata. She wrote to her officers directing them to engage the Coast Guard in the protection of turtles (called Operation Geeturt), which marks the first occasion where armed forces were called into service for protecting the environment.

Indira Gandhi received many awards for her commitment to nature conservation, including the Order of the Golden Ark from the Government of Netherlands, and the John C. Phillips Memorial medal, the highest accolade of the IUCN, which was received posthumously by her son, Rajiv.

Through her time as PM, many stalwarts played a key role in advising her on wildlife conservation – Karan Singh, Billy Arjan Singh, Kailash Sankhala, Zafar Futehally, Salim Ali, Anne Wright, Ranjitsingh and Ashok Khosla. She always had time to listen to concerns about nature and conservation, and respond to both national and international conservationists who wrote to her on the subject. As Chair of the Indian Board for Wildlife, she made it a point to attend all meetings and was attentive to issues, something that no other PM has done.

Indira Gandhi's engagement with nature is absolutely fascinating. It was a study in both commitment and passion. The book under review provides a vivid account of her 'life in nature' told largely through her correspondence with friends, family, bureaucrats, politicians, conservationists and biologists. The book provides rich details of the many battles she fought, and her own struggle to balance issues of environment and development. Though Ramesh claims to take an objective stance, there is an unbridled admiration of her courage and determination to defend nature. At the end, he says that while she was enigmatic, 'the *essential* Indira Gandhi was [a] committed conservationist'. All those who read this book will have to agree.

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Annual Review of Nuclear and Particle Science, 2016. Barry R. Holstein, Wick C. Haxton and Abolhassan Jawahery (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 66. vi + 473 pages. Price: US$ 102.

A framework that encompasses all known elementary particle interactions, namely the strong, weak and electromagnetic (unified into an electroweak) interactions has been established over the last several decades. This framework which does not include the gravitational interactions has come to be known as the 'standard model'. It is a theory of interactions between quarks and gluons, which make up the strong interactions, and quarks, charged 'leptons' (an electron being one, and muon and tau lepton being the other two), and their electrically neutral counterparts, which are known as neutrinos of the electron, muon and tau type, which interact via the exchange of photons, and the so-called W and Z bosons. The fact that neutrinos are electrically neutral has rendered them very challenging to be probed in experiments. In particular, even today we do not know their masses; we only know that they can flip back and forth between the various types; that there are mass differences between them, taken two at a time, and we do not yet know the sign of this mass difference. We also do not know whether they are 'self-conjugate' or not, in that we do not know if they are their own anti-particles. Turning to the force carriers, the gluons and the photon are massless, while the W and Z bosons are massive and it is the famed Higgs mechanism that gives rise to their masses, and in turn to the Higgs boson, something that was needed for the consistency of the theory, and discovered in 2012 by the CMS and ATLAS experiments at the Large Hadron Collider (LHC) in CERN, Geneva.

The standard model constituents and their interactions are known at the microscopic level. In order to make up the known matter out of them which are, for example, protons and neutrons made up of light quarks, and nuclei made up of protons and neutrons, which themselves fuse and make larger and larger nuclei, indeed to give rise to all the matter in the world that we see. One has to solve these theories, in various environments, including such as the Big Bang, a singularity from which the Universe is said to have arisen, or in stellar interiors. The Big Bang is a consequence of the Einstein equations for a homogeneous and isotropic cosmology first proposed by Friedmann and described in detail by Robertson and Walker, and supported by the observation of Hubble expansion, when the clock is made to run backwards. The validity of Einstein's General Theory of Relativity can also be checked in other extreme environments in the Universe, such as in the merger of neutron stars or of black holes, or neutron stars and of black holes, which gives rise to gravitational radiation. Indeed, the first observation of gravitational waves has now been made by the Advanced LIGO collaboration, which marks one of the most exciting scientific discoveries of the era.

The above said, it is also true that the picture of elementary particle physics we have must be in concordance with our understanding of phenomena at the largest length scales. Indeed, it is astrophysical and cosmological settings that provide an ambience for testing these interactions, and in turn the interactions together give rise to the structures that are seen. Furthermore, it is also necessary to check our understanding of matter at extreme conditions of density and temperature in a controlled environment, that has been made possible today in the most sophisticated laboratories in the world.

The present collection of articles is one which gives a wide selection of topics that are of relevance and represent active research in various fields associated with the background above. Thus, articles in the series 'Advances in Particle and Nuclear Science' in the last decades include both elementary particle physics, nuclear physics, both theoretical and experimental; cosmology and structure of matter at the largest length scales as well as advances in cosmology and astrophysics, and now in observational gravitational radiation.

But is it so that all the above is related to the fact that there are human beings in the Universe? Is there something peculiar about the quantities in the Universe, including say the charge of the electron that has made human life possible? Is this even a scientifically permissible question? Are we in one of several possible 'multiverses'? These ideas are reviewed by Donoghue in the opening article of this collection 'The multiverse and particle physics'. Opening up this quasi-philosophical question will influence the kind of experiments that will be carried out and pose interesting questions which can be settled scientifically. Of the important questions facing the Universe itself is the issue of its acceleration. In this regard, Joyce *et al.* offer us a glimpse on the debate around 'Dark energy versus modified gravity'.

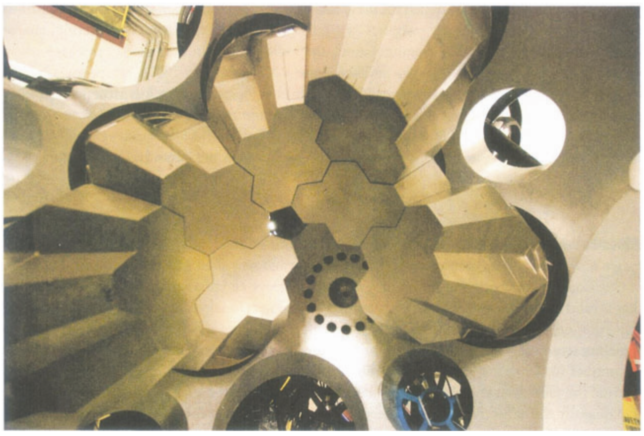
Fernández and Metzger present a comprehensive guide in the article on 'Electromagnetic signatures of neutron star mergers in the advanced LIGO era', which is a subject in its infancy. Improvements could pave the way towards a concurrent observation of gravitational wave signatures and electromagnetic signatures, thereby improving our understanding of the phenomena. Whereas it is a great challenge to study the evolution of a supernova and its core-collapse in the world in which we live, a useful model is one with a reduced number of spatial dimensions. Janka *et al.* discuss some fascinating aspects in 'Physics of core-collapse supernovae in three dimensions: a sneak preview'. Cosmic rays have been some of the earliest known harbingers of information from the far reaches of the galaxy and the cosmos. What exactly are they made up of? Cowsik discusses some of their properties in 'Positrons and antiprotons in galactic cosmic rays'.

The collection has several articles on neutrino physics due to the importance of this field. Diwan *et al.* review 'Long-baseline neutrino experiments' which are expected to shed light on various neutrino parameters, including the mass and oscillation parameters. Mosel discusses in detail what can be learnt from interactions with complicated targets in 'Neutrino interactions with nucleons and nuclei: importance for long-baseline experiments', whereas Gouvêa discusses 'Neutrino mass models' eponymously. An important source of neutrinos are the nuclear reactors, and these have contributed significantly to generations of experiments. Their properties are discussed by Hayes and Vogel in 'Reactor neutrino spectra'. Neutrinos also leave their imprint on the cosmic microwave background and participate in the evolution of large-scale structure. This detailed subject is reviewed by Abazajian and Kaplinghat in 'Neutrino physics from the cosmic microwave background and large-scale structure'.

Gelis and Schenke introduce us to the subject of 'Initial-state quantum fluctuations in the little bang', pertaining to the conditions of the Big Bang that are replicated in the laboratory in heavy-ion collisions. The latter imitates the Big Bang by colliding very dense nuclei of heavy-ions at high rates. This will enable us to improve our understanding of the dynamics and equilibration of the medium under extreme conditions. Proton–lead collisions which are nearly as important as the usual proton–proton mode are reviewed by Salgado and Wessels in 'Proton–lead collisions at the CERN LHC'.

Whereas quantum field theory is the fundamental tabletop on which elementary particle physics interactions are studied, the subject itself throws up questions of when it can be solved and poses several challenges, when traditional methods of solving it fail. Dunne and Unsal review some developments in 'New non-perturbative methods in quantum field theory: from large-N orbifold equivalence to bions and resurgence'.

Smith introduces us to 'Triggering at the LHC', which is an important issue in tracking data at all the LHC experiments, namely CMS, ATLAS, ATLAS and LHCb, during the first run of the LHC. Run 1 followed by Run 2 and the challenges therein have been reviewed by Campana *et al.* in 'Physics goals and experimental challenges of the proton–proton high-luminosity operation of the LHC', which looks at both the accelerator and detector issues. A venerable collider at DESY, Germany was HERA, which collided electrons and protons and gathered data which continue to be analysed long after its shutdown. It probed the structure of the proton at many length scales and extracted information which is



The seven detector modules of GRETINA arranged in the close-packed configuration. Each detector module comprises four hexagon-shaped germanium crystals. This photograph, taken during the campaign at the National Superconducting Cyclotron Laboratory, shows the front face of each module as viewed from the target position.

needed for accurately modelling the proton when it participates in collisions. Abt summarizes this information in 'The proton as seen by the HERA collider'.

Elementary particle physics at lower energies also plays an important role as larger amounts of data can be gathered and analysed, and precision studies of the bound states of gluons can be made with high accuracy. An important facility in China carried out several activities over a couple of decades, clarifying the role of the charm quark. Its accomplishments and future are reviewed in a detailed article by Briere *et al.* Excited nuclei decay to lower excited states and ground state through the emission of gamma rays, and the study of these is a sensitive probe of the collective structure of nuclei. Fallon *et al.* introduce us to the most recent advances from the rare-isotope beams at the National Superconducting Cyclotron Laboratory in Michigan, USA, where the tracking array is carrying out its science in 'GRETINA and its early science'. Putting together nucleons and getting even simple properties of small nuclei right is no mean feat. Phillips introduces us to some of these fascinating developments in 'Electromagnetic structure of two- and three-nucleon systems: an effective field theory description'.

In conclusion, I would like to commend the editors on a fine selection that introduces the reader to all the important developments in the field of elementary particle physics, nuclear physics and cosmology, all in one sweep. It is a great addition to any library of repute.

ACKNOWLEDGEMENT. I thank Ratan Sarkar (Indian Institute of Science, Bengaluru) for a careful reading of this review and providing useful comments.

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