Annual Review of Nuclear and Particle Science. Boris Kayser *et al.* (eds). Annual Reviews, P.O. Box 10139, Palo Alto, California 94303-0139, USA. 2006. Vol. 56, 640 pp. Price not stated.

The present volume is a collection of thirteen review articles spanning the length and breadth of elementary particle physics research, with foci on the interrelationship of the subject with astrophysics and cosmology, and on results arising from current generation of experiments at collider facilities and expectations from upcoming ones. There are strands which unify the presentations, which devote themselves to tests of the so-called standard model of elementary particle physics including at extreme laboratory, cosmological and astrophysical conditions.

The standard model of elementary particle physics is one in which the electromagnetic and weak interactions are described in a unified framework, the electro-weak model, while the strong interactions stand apart. A lot is known about the electro-weak model and indeed one of the important predictions of this model is the existence of the as-yet undetected Higgs particle. This is so central to the subject that we first devote our attention to the article on the possible experimental discovery of this particle at an upcoming facility, before turning to the other theoretical and experimental issues in the field addressed in the other articles in the volume.

The article by Daniel Froidevaux and Paris Sphicas is devoted to the two general-purpose large detectors known as ATLAS (A Toroidal LHC ApparatuS) and CMS (Compact Muon Solenoid) at the massive facility known as the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland, whose goals include the detection of the Higgs and determination of their properties. The LHC is expected to start collisions of protons on protons each at the energy of 7 TeV (Tera electron Volts) later this year in test runs, which are accelerated in tunnels with circumference of 27 km that run underground in Swiss and French territory. This is one of the greatest experiments ever planned and all the scientists in the field are eagerly awaiting results from this experiment. The two detectors mentioned above have the ability to either observe or rule out scenarios and extensions of the standard model, many of which have compelling theoretical foundations, but will eventually have to face the test of experiment. The article here reviews the details of design and layout of the two detectors. There are many mind-boggling features of these detectors which are listed in seemingly dry numbers, e.g., the weight of the ATLAS detector is 7000 tons, while that of CMS detector is 12,500 tons, while the LHC is expected to carry out 800 million collisions per second. The size of the detectors was arrived at from considerations of the abilities that they must have to detect the particles that result from the collisions and the need to resolve tracks, etc. Also of note is the computing requirements of these experiments which has spawned a whole new industry that has come to be known as GRID computing. The article here gives a comprehensive account of all the ingredients that are needed to launch this exciting new adventure. It may also be worth noting here that at the LHC there are three other smaller experiments known as ALICE that is geared to study the collisions of lead nuclei, while LHCb will study b quarks and anti-quarks and contribute to our understanding of the phenomenon of matter and anti-matter asymmetry (also known as CP violation (C: charge conjugation, P: parity)). Finally, a new experiment called TOTEM (Total Cross Section, Elastic Scattering and Diffraction Dissociation at the LHC) has been commissioned.

One of the great problems that is faced by experiment and theory is the ubiquitous nature of the strong interactions; it is very hard to separate out the effects due to these which influence the determination of the properties of the weak interactions. The latter has several important parameters in its defining theory, which among other things, leads to mixing among quarks. Quarks themselves participate in electromagnetic, weak and strong interactions and are the constituents of normal matter to which we are accustomed to, such as protons and neutrons (which belong to a family known as baryons) and somewhat less familiar particles known as pions and kaons (which belong to a family known as mesons; baryons and mesons are collectively known as hadrons, which are the bound states that result from the interactions between quarks and gluons and are said to constitute the 'spectrum' of the strong interactions). Therefore it is very important to carry out as many high precision experiments as possible involving mesons and baryons. Furthermore, at extreme conditions of pressure, temperature and density, the properties of the strong interactions change dramatically in comparison with those at moderate ambient conditions. This exploration is crucial for the determination of the fate of stars, and for our understanding of, e.g. the big-bang and cosmology. The present volume features several articles on these subjects.

The article by Andreas Hoecker and Zoltan Ligetti which reviews CP violation and the CKM (Cabibbo–Kobayashi–Maskawa) matrix is an illustration of the above; the mysterious CP violating effects are seen only in certain meson systems but are associated with the weak interaction. The complete study and characterization of these effects has been a long challenge experimentally as well as theoretically and places important constraints on the extensions of the standard model to other exotic scenarios. Of related interest is the article on the Physics of DAFNE and KLOE, where the former is a collider that collides electrons and positrons to produce a particle of mass 1.02 GeV (we have put the velocity of light, c to 1, a common convention) whose decay then produces a large number of kaons. KLOE is the name of the detector which studies these kaons and has over the years gathered a lot of information on the properties of kaons and also provides a measurement of one of the elements of the CKM matrix responsible for the u to s transition. There are two other experiments known as DEAR and FINUDA at this facility where the former studies an exotic atom known as kaonic-hydrogen, where an electron is replaced by a kaon and the resulting atomic physics is studied, while the latter studies so-called hypernuclei where a nucleon is replaced by a hyperon, a strange counterpart of the conventional nucleon. The aim of the DEAR experiment is to provide information on meson–baryon properties which will be a test of effective theories of strong interactions. On the other hand, hypernuclei experiments have the advantage that they can beat the restrictions placed by the Pauli exclusion principle for identical particles; a hyperon is distinguishable from the other nucleons already present in the nuclei and thus helps in this enterprise!

These are sensitive laboratories of physics in the low-energy domain in sharp contrast to the LHC which is at the extreme high energy limit. The review by Michael J. Ramsey-Musolf and Shelly A. Page is on the esoteric topic of Hadronic Parity Violation, which also features the difficulty of studying weak interaction properties in systems with strongly interacting constituents. In addition to reviewing the effective theories relevant to the system, the authors have also described certain intriguing experiments that will probe this system. On the other hand, the article by Gerald A. Miller, Allena K. Opper and Edward J. Stephenson looks at an exclusive strong interaction problem in their review article on Charge Symmetry Breaking and QCD, which is associated with the fact that the masses of the u- and d-quarks are somewhat different. This leads to some experimental signatures which have been seen recently for the first time, in the processes where a neutron and proton combine to form a deuteron in the final state along with the emission of a neutral pion, and the capture of one deuteron by another producing an alpha particle and a neutral pion.

There are three articles in the volume devoted to matter at extreme conditions: the first on (a) Results from the Relativistic Heavy Ion Collider (RHIC) by Berndt Mueller and James L. Nagle, and the closely related article on (b) Hydrodynamic Models for Heavy Ion Collisions by P. Huovinen and P. V. Ruuskanen, on (c) Dense Matter in Compact Stars by Dany Page and Sanjay Reddy. The collider RHIC at Brookhaven Laboratory was recently in the news due to the financial problems it faced in continuing its operations, but readers of the article by Mueller and Nagle can take heart at the achievements thus far, which include tests of the idea of a quark-gluon plasma, a state of matter which may have existed at the time of the big bang. Since the properties of the medium in collision cannot be treated *ab initio*, one resorts to modelling of the sort reviewed in the article by Huovinen and Ruuskanen. Indeed, at the LHC there will be further investigations of this type in the Pb–Pb collisions. The article by Page and Reddy, on the other hand, looks at matter in extreme conditions in an astrophysical setting, as in neutron stars. The article reviews the constraints on many significant models in light of recent observational information.

A fascinating tour of the history of the early Universe after the big bang through the presently acknowledged paradigm of inflation, and the associate phase transitions is presented in the article on Present Transitions in the Early and Phase Universe by D. Boyanovsky, H. J. de Vega and D. J. Schwarz. The authors point out that this study combines several traditional disciplines like cosmology, statistical mechanics and observational information to arrive at the comprehensive picture of the history of the Universe. An interesting discussion is presented on the testing of the theories at accelerators such as RHIC.

Two articles on neutrino physics include the first on Primordial Neutrinos by Steen Hannestad and on Neutrino Masses and New Physics by R. N. Mohapatra and A. Y. Smirnov. In the currently accepted picture of standard big bang cosmology, the neutrinos that would have been present in large numbers in that epoch would have ‘decoupled’ from matter and would have left an imprint on the cosmic microwave background radiation. Furthermore, one of the litmus tests of the scenario has always been the prediction for the abundance of light nuclei, which in turn constrain the nature of the primordial neutrinos. In the present article by Hannestad, the cosmological constraints on neutrino masses and properties are reviewed. The field of neutrino physics received a massive boost from the definitive finding of neutrino oscillations by the Sudbury Neutrino Observatory some years ago, heralding as it were, physics ‘beyond the standard model’. A lot is now known about neutrino properties, which have also been reviewed recently in the pages of *Current Science* [Ananthanarayan, B. *et al.*, *Curr. Sci.*, 2006, **91**, 864]. The review of Mohapatra and Smirnov gives an up-to-date account of the status of this subject.

Two articles stand more or less on their own, the first on Physics of a Rare Isotope Accelerator (RIA) by D. F. Geesaman *et al.*, and on Searches for Astrophysical and Cosmological Axions by Stephen J. Asztalos *et al*. The RIA is a proposed facility to carry out experiments that will probe the issue of nuclear stability in an unprecedented manner. The implications are expected to be far reaching and will also provide tests of accepted paradigms of nuclear structure and stability. The article by Asztalos is a review on the subject that is captured in the title. Axions are particles that arise in a proposed solution to a problem known as the strong CP problem of the strong interactions. However, it is very difficult to find any real constraints on the masses and couplings of these particles which could virtually be anything. However, if present in the Universe they could have a crucial impact on its history during the big bang and afterwards, and also in the astrophysical setting as they could lead to unacceptably fast cooling of stars. The present article reviews the status of the field.

In summary, the present volume of reviews is a very useful handbook for the practitioner and the theorist. The extensive references provided are of immense value and the articles are an excellent archival source. It is a must for any library that serves researchers in the field of elementary particle physics especially to those who are in the interdisciplinary field of astroparticle physics.

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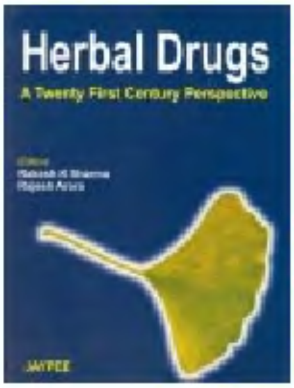

Herbal Drugs. Rakesh K. Sharma and Rajesh Arora (eds). Jaypee Brothers Medical Publishers (P) Ltd., B-3, EMCA House, 23/23B, Ansari Road, Daryaganj, New Delhi 110 002. 2006. 666 pp. Price: Rs 695.

The use of herbal drugs is synonymous with traditional systems of medicine. Most often, herbal drugs are prescribed as preparations that contain more than