Annual Review of Nuclear and Particle Science Vol. 54. Boris Kayser *et al.* (eds). Annual Reviews Inc, 4139, El Camino Way, P. O. Box 10139, Palo Alto, California, USA. 2004. 590 pp. Price not mentioned.

The volume is a compilation of articles on many of the important subfields and trends in research in elementary particle physics. Great amount of experimental effort is going on in understanding the properties of matter at the smallest length scales imaginable, and indeed at the highest energies accessible in terrestrial experiments and/or at the greatest possible levels of precision attainable with today's technology, as well as in observational efforts in settings in the cosmos as in stellar interior, and galactic halos.

To recall, the 'standard model' of elementary particle interactions is the framework within which the electromagnetic and weak (now known as the electro-weak), and strong interactions are described, and whose degrees of freedom are, for example, the electron and its neutrino, the u- and d-quarks, which interact among themselves via the exchange of particles like the photon, the W and Z bosons and the gluons. However, the strong interactions bind the quarks within 'hadronic' matter such as the proton and the neutron, and the pions to name a few particles. More massive counterparts of these particles include, for example, the muon and its neutrino, the strange and charm quarks. Despite heroic efforts, the problem of describing the collective properties of such matter such as the properties of the nucleons, and several properties of neutrinos, including knowledge of their masses is far from complete.

The one force that is not yet included in the framework of a quantum theory is that of the gravitational force. However, this does not limit our understanding of the operating of this force, at the interplanetary, interstellar and intergalatic scales, where more and more knowledge is gathered on a daily basis.

The collection of articles in the volume under review weaves through all the themes touched upon above. Starting out with a comprehensive account of the work of the well-known theorist Lincoln Wolfenstein in his own words, and who has contributed enormously to the theory of weak interactions, especially to the phenomenon known as CP violation (C is the charge conjugation which relates particles to anti-particles, and P the parity, or mirror symmetry) and also to the scenario of matter-enhanced flavour oscillation, the favoured solution for the 'solar neutrino problem', which is known as the Mikheyev–Smirnov–Wolfenstein effect. An article of related interest is the one by Kubodera and Park on the solar helium–proton reaction, followed by an article by Collon, Kutschera and Lu on tracing radionuclides in the environment. The reader will recall that the solar neutrino problem was established using this technique, and Ray Davis was awarded the Nobel Prize for this work.

As mentioned in the preamble of this review, despite the knowledge of the microscopic theory of strong interactions, the collective properties of strongly interacting matter are not amenable to *ab initio* computations. Indeed, establishing these properties themselves poses a considerable experimental challenge, as is the theory required to interpret the information so obtained. One gadfly in this field has been the so-called spin structure of the nucleon, and in the present collection the article by Drechsel and Tiator reviews the theoretical background, which is a general one and the current status of the present experimental information and an outlook for the future. Also of interest in this realm are the articles by Ji on generalized parton distributions, and by Hashimoto and Onogi on heavy quarks on the lattice, where it might be recalled that 'partons' are the effective constituents of hadrons, while 'lattice gauge theory' is the remarkable framework for solving the dynamics of the strong interactions on the computer. A curious article is one on the approach of the great Russian theorist, the late Vladimir Gribov to the theory of strong interactions, by his colleagues Dokshitzer and Kharzeev.

A remarkable experiment that has been performed is the precision measurement of the anomalous magnetic moment of the muon, a short-lived cousin of the electron, at the Brookhaven National Laboratory. Indeed, any window to physics beyond the ambit of the 'standard model' could come from deviations of its predictions for observables. The experiment is a pioneer in this direction, viz. that of low energy and high precision. In the present volume we find two articles, one each on the experiment and on the theory of the measurement and its consequences by Hertzog and Morse and Davier and Marciano respectively.

Other traditional fields represented in this volume are those of nuclear physics and scattering theory, with articles on the nuclear structure of very heavy nuclides by Leino and Hessberger, and Hyde-Wright and de Jager respectively.

A noteworthy article by Dawson and Oreglia is on the new physics opportunity with a TeV linear collider (where TeV stands for Tera electron Volt), which points out how at such a facility, something that is under serious consideration in the high energy physics community and with scientific councils of several Governments, one might explore the interactions of particles which have not yet been produced due to their being too heavy to be produced at present-day facilities, or indirectly make their presence felt. At such a facility, popular scenarios such as 'supersymmetry' may be established, or may well be ruled out.

And now to the cosmos, where there has been a persistent problem associated with the fact that all the 'visible' matter in the universe cannot account for many observed properties of large-scale structure, and instead lead to the belief that in the universe are copious amounts of 'dark matter'. Such matter could be detected in terrestrial high precision observatories using special techniques. In the volume under review are articles by Gaitskell and a related one on backgrounds to sensitive underground experiments by Formaggio and Martoff. In future, there would be several generations of experiments that would probe properties of cosmic rays, neutrinos, and look into the possibility of detecting hypothetical magnetic monopoles.

Standing all by itself is the article on gravitational wave astronomy by Camp and Cornish, on the possibility of directly observing the as yet unproved prediction of the general theory of relativity of Albert Einstein. The article reviews in great detail the theory and the experimental status of this field.

In summary, this volume plays the important role of providing for the practioner, a useful handbook on the status of the field as it stands on the threshold of the world Year of physics 2005.

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