a compound of composition $[\text{IrCl}_3, 3\text{R}_2\text{S}]$ isolated in two isomeric forms differing in colour and in solubility in organic solvents (published in 1932 and 1933). The more soluble isomer is orange yellow in colour while the less soluble isomer is red. On the basis of composition, stability and non-electrolytic nature of the yellow isomer in acetone solution, Prafulla Chandra concluded that it is a hexacoordinated compound $[\text{IrCl}_3(\text{Et}_2\text{S})_3]$ and suggested that the red isomer is of similarly composition. He assigned $\text{cis} (\text{fac})$ and $\text{trans (mer)}$ geometries for the yellow and red isomers respectively. Subsequent NMR and other physical studies, however, confirmed that the yellow species is actually the trans isomer and the red one was actually a dimerization isomer. Though this early assignment of Ray was discarded, it is Ray’s original synthetic work that generated interest in these compounds. Ray’s iridium work was indeed pioneering and finally led Ray’s original red one was actually a dimerization iso-

I recommend this book to all college and university library as a dispassionate analysis of Ray’s chemistry.

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This is a handy book of less than five hundred pages for the beginning student, published by New Age International. It introduces the basics of the topics, mentioned in the title, aimed at the advanced undergraduate and the starting graduate student. It is an admirable attempt since, the V–A theory is properly de-

Chapter 3, covering beta decay within the Fermi theory, is beautifully written. It sets the right historical perspective and covers all pertinent experiments – clearly showing the author’s mastery over the subject. The V–A theory is properly de-

Chapter 4, entitled ‘Fundamental Inter-

This chapter, entitled ‘Synthesis of micro- and macro-cosmos’ and introducing some fundamental notions as well as defining several basic quantities in both areas, is quite readable. I especially liked the six tables at the end. There are, however, a couple of minor glitches. The expression for Planck time is given without defining it as $L pe^{-1}$ and that for the Planck temperature (with a $e^2$ missing from the numerator) is given without ex-

The second chapter provides a clear and useful summary of basic elastic and deep inelastic lepton–hadron processes and also touches upon different types of colliders used in high energy physics. Unfortunately, accelerators with fixed targets as well as $e^e$ colliders are men-

Chapter 2, entitled ‘Particle Physics and Cosmology’, is somewhat misnamed; it should have been called ‘Gauge Theories of Strong, Electromagnetic and Weak Inter-

Chapter 4, entitled ‘Fundamental Inter-

Further Reading list here were more

Chapter 3, covering beta decay within

Chapter 4, entitled ‘Fundamental Inter-

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sources of non-accelerator neutrinos, as discovered, are properly enumerated. However, I was disappointed to see no mention of the discovery of atmospheric neutrinos at the Kolar Gold Fields in India. Then the author provides a survey of the global landscape of neutrino oscillation experiments. There is no mention of T2K/T2HK and DUNE, but otherwise the survey is adequate. Coming to neutrino oscillations themselves, the phenomenon is nicely explained, first with two and then with three neutrino flavours. Theoretical topics, such as the neutrino mass hierarchy and the TBM matrix, are also touched upon. Unfortunately, the TBM discussion is outdated since Daya Bay and other experiments have since established that \( \theta_3 \) is nonzero and \( \approx 8^{\circ} \), thereby ruling out TBM. There is also a nice, compact treatment of neutrino oscillations in matter including the MSW effect. The discussion ends with a short summary of long-term perspectives.

The rest of the book is devoted to an introductory presentation of modern cosmology. Chapter 7 introduces the basics of Big Bang Cosmology and the subsequent chapter 8 presents the elements of the Standard Cosmological Model. In chapter 7 the Hubble expansion constant \( H \) and the Doppler redshift \( z \) as well as Hubble’s law are illustrated. I wish the author had given the full relativistic expression for \( z \) in terms of \( c \) and the velocity of recession \( v \). Also, it is unfortunate that the contribution of George Gamow to the Big Bang origin of the Universe is omitted, though his role in formulating Big Bang Nucleosynthesis (BBN) is mentioned. Following the Big Bang, the onset of initial radiation domination and the subsequent transition to matter domination are briefly but satisfactorily explained and the steady state model debunked. It is alright to quote, as done here, standard formulae without derivation in an elementary text such as this, but at least proper references to sources with such derivations should have been given in appropriate places. BBN is compactly but adequately treated in one section; I particularly enjoyed reading the box on the Saha equation in this context. Then the author discusses the thermodynamics of the Early Universe, nicely sketching its evolution from its Big Bang origin to the formation of atoms and molecules. This is followed by a section on the Cosmic Microwave Background Radiation (CMBR). I was pleasantly surprised at the fairly detailed nature of the discussion of the CMBR anisotropy alongside COBE and WMAP results and the mention of the Sachs–Wolfe effect. However, data from the later and more current PLANCK satellite are unfortunately not mentioned. The section ends with a short discussion of the number of effective neutrino species probed by CMBR.

In the rest of chapter 7, the author proceeds to treat the subject of nuclear astrophysics to lay the setting for a subsequent discussion of supernovae. The discussion is naturally focused on the behaviour of a collapsing star. After elucidating the competing roles of gravity and electron degeneracy pressure (I wish it were mentioned that the latter originated from the Pauli Exclusion Principle), the Chandrasekhar Limit is derived. Then the author treats the topic of stellar structure in order to deal with the sequence of star formation – from Red Giants to White Dwarfs – including our Sun. A serious omission here is the absence of any illustration with the Hertzsprung–Russell diagram. Turning then to nuclear reactions, the author discusses the formation of nuclear elements in stars in a surprisingly detailed way that is highly welcome. Finally, supernovae explosions and different supernovae relics are covered. However, the premier diagnostic role of type Ia supernovae in the discovery of the acceleration of the Universe is postponed to a later discussion in the next chapter. Chapter 7 ends with a fairly detailed discussion of the information on neutrinos that could be extracted from supernovae data.

The final chapter 8 on the Standard Cosmological Model aims quite high – trying to cover a wide span of topics. To start with, a lightning review of GR and the FRW Universe (including the cosmological constant and inflation) is presented. This is followed by an overview of the important aspects of observational cosmology. I liked the table containing information on various satellite missions and ground-based efforts currently in progress. Turning to large scale structure, the author provides rapid fire treatments of gamma ray bursts, neutron stars and white dwarfs. These are followed by a somewhat more ambitious coverage of black holes and their connection to a quantum theory of gravity, as gleaned by Hawking. Next, the author discusses the evidence for and the possible nature of Dark Matter, briefly mentioning current searches including both space- and ground-based efforts. This is followed by a quick coverage of critical issues in the standard cosmological model. These include the horizon and flatness problems (though I wish that the success of inflation in tackling these were emphasized a bit more here). There is also a brief mention of Dark Energy. The next section contains a compact introduction to gravitational waves including their detection and a reference to their origin. Then comes the last section 8.4 where the author truly comes into his element as a researcher in relativistic heavy ion collisions. He provides the reader with the picture (in the temperature-baryon density plane) of a possible synthesis between the physics of the Early Universe and the formation of Quark–Gluon Plasma (QGP) in RHIC and ALICE experiments. Finally, the reader’s imagination is tickled by brief mentions of M-theory and the search for earthlike planets.

Three appendices appear at the end, containing elementary expositions of theoretical and statistical tools used in the study of these areas.

Occasional grammatical lapses appear in this book – with singulars and plurals as well as articles. There are also several printer’s devils, e.g. Fred Hoyle’s name is misspelt on p. 277. In case there is another edition, a more careful proof-reading will help. I also think that ‘Majoran’ and ‘Dark Energy’ should be included in the Glossary. Otherwise, this book is a praiseworthy effort. It is not supposed to compete with the more detailed Particle Physics book by Palash Pal or the two extensive volumes on the Early Universe by Gorbunov and Rubakov. Those books would be needed to develop a more thorough knowledge of the mentioned subjects. However, Prof. Mukherjee has written an excellent introduction to these current areas, which are in the limelight, for advanced undergraduate and beginning graduate students – especially in India. This work is evidently a labour of love and the author deserves kudos for his effort.

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