In spite of my criticism on some issues, Greenspan's book is indispensable to historians of science. That she has managed to arrange 'Born's archive' at the American Institute of Physics is laudable. For future work, it will be a major source of information for other historians and scientists. It is a matter of personal taste, but I still emphasize that the best point in the biography is that the wife of a physicist is 'allowed to speak' – a new trend in the history of science.

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Monte Carlo Methods in Statistical Physics. K. P. N. Murthy, Universities Press, 3-5-819 Hyderguda, Hyderabad 500 029. 2004. 128 pp. Price: Rs 195.

The number of books on scientific and technical topics published in India per year is quite small, if we exclude the routine reprints of standard textbooks and consider books above the popular science level. Thus, this book by K. P. N. Murthy, is welcome. May this tribe increase.

In the preface, the author says that he hopes that that the book will be 'a useful addition to the bookshelves of researchers and students'. Note that researchers come before students. The book is intended as a reference book for researchers, and the style is more like that of a handbook, rather than a textbook. For the younger readers, who have never seen a handbook, it is a concise reference book covering a particular subject. These were quite popular in the earlier parts of the previous century, but the rapid growth of knowledge has made this genre a bit old-fashioned. A rather well-known series called *Handbuch der Physik*, published by Springer Verlag during 1955–84, ran into 55 volumes. Hardly a handbook. Of course, the rate of growth is even larger now. I am old-fashioned, not the type who would welcome the idea that soon we would be able to get a 'thumb-drive of physics' with many gigabytes of uncompressed information. So, a short monograph that can give the reader basic knowledge of a subject in a hundred or so pages, is welcome.

Even though the author seems to assume that the reader is already familiar with notions like ensembles, microstates, etc., the first section is devoted to a brief recapitulation of these ideas. The Monte Carlo method is a label used nowadays for any algorithm to simulate the behaviour of a system that makes use of random numbers. There is a discussion of different ways of generating pseudo-random numbers in a computer, and also how to test if a random number generator is satisfactory. Most of the random number generators give random numbers that are uniformly distributed between 0 and 1. If one wants a number that has, say, a Gaussian distribution, one has to make a change of variables. The book discusses some of these techniques. This is followed by a discussion of importance sampling, and Markov chains. The Metropolis algorithm for generating a sample with distribution given by the Maxwell–Boltzmann ensemble, and the crucial question of estimating errors in the calculated results are discussed.

The book does not deal with the Monte Carlo method only as a technique. There is a fairly extensive discussion of what kind of knowledge about behaviour of physical systems, modelled as systems in thermal equilibrium, can be obtained from Monte Carlo studies. So, there is discussion of critical phenomena, Ising systems, and how finite-size scaling techniques are used to extrapolate the results of finite-sized samples on the computer to much bigger systems of physical interest. There is a fair amount of discussion of estimating properties of clusters, in percolation, and in systems near phase transition, etc. The Hoshen–Kopelman algorithm for efficiently collecting the statistics about sizes of different clusters in a given multicluster system is discussed. Divergence of relaxation times near phase transitions, and the Swendson–Wang algorithm for updating clusters that reduce this difficulty are discussed. Other techniques that reduce computer time for Monte Carlo simulations, like histogram technique and multi-canonical sampling methods are discussed briefly.

The present book assumes some familiarity with the basic ideas of statistical mechanics on the part of the reader. For example, the book opens with 'A macroscopic system consists of a very large number of microscopic constituents'. This is a simple observation, but only if one is already familiar with the meanings of the various four-syllable words. A student wanting to learn about the subject for the first time would be better-off reading from a book that is not so terse. For example, there are well-known monographs on Monte Carlo methods by Binder and a more recent one by Newman and Barkema. On the other hand, a research scholar, who is working in this subject, but wants to know quickly what the histogram method is, would certainly find this book useful. Even for students, the price of this book makes it much more affordable than the others.

The choice of topics covered is, of course, determined by the interests and expertise of the author. Even so, I think that the different algorithms for constructing, counting and updating random clusters take a larger part of the book than justified. Some discussion of application of Monte Carlo methods to the study of problems in biology, or chemistry (conformations of biopolymers or determining rates of chemical reactions), or astrophysics, etc. would have made the book more useful to a wider readership. Or perhaps even more exotic applications, like simulations of a cricket match or the stock market could have been discussed. In the end, the author discusses the Jarzynski equality, an important recent advance in non-equilibrium statistical physics. However, this topic is rather disconnected with the rest of the book, as there is no discussion of non-equilibrium systems in the book.

Given the nature of the book, philosophical issues about the conceptual foundations of statistical mechanics are not discussed. For example, about the ergodicity hypothesis, the book has only this to say in a footnote on page 3: 'This is an axiom; the entire edifice of statistical mechanics is built on this axiom'. It would have been better if such an impor-

tant idea found a place in the main text, and not in a footnote. A short paragraph would certainly not have been too much out of place, specially as the section is aimed at explaining what is an ensemble.

I was not too happy with the quality of production. In a book, I like to have a new chapter start on a new page. With heavy technical subjects, one looks forward to these end-of-chapter markers as psychological boosters. They are like a pat on the back for having persisted so far, or as inducement to continue just a bit longer. I think the benefits are well worth the added cost of extra paper. Unfortunately, in this book, a new chapter starts just where the last one is finished. The number of misprints is not large, but a more watchful copy editor would have spotted errors like the title of the book mentioned incorrectly in the Foreword. There are other goofs, e.g. the book informs that the Monte Carlo method is 'named after a city, in the province of Monaco, south of France', an irrelevant bit of geographical information, but forgets to mention the casinos that give the method the name. Some pictures of percolation clusters, or of the Marsaglia lattice structure would have helped the reader better than words.

On the whole, I think the book is likely to be useful to practitioners of the Monte Carlo technique, and to students wanting to learn about the technique. It would be a good addition to libraries of universities and research institutes.

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Essentials of GPS. N. K. Agrawal. Geodesy and GPS, 202, KNR Apartments, Street No. 8, Habsiguda, Hyderabad 500 007. 2006. 145 pp. Price: Rs 260.

In the 1970s, the US Department of Defense developed a super-precise form of worldwide positioning for military applications at a huge cost of about 12 billion US dollars. This has resulted in a good Global Positioning System (GPS) and has changed navigation forever.

GPS is a worldwide radio navigation system formed from a constellation of 24 satellites and their ground stations. Satellites transmit information towards the earth and the GPS receivers take the transmitted information and use a form of triangulation to calculate the user's exact location, accurate to a few metres. Advanced form of GPS can make measurements better than a centimetre. Soon, GPS will become an indispensable tool of utility like the telephone.

The World Geodetic System (WGS-84) utilizes detailed gravitational irregularities of the earth, and is used as a standard earth model for GPS applications.

Maps and coordinates in India are in a local geodetic reference system based on Everest Spheroid – Indian geodetic system. The coordinates in this system may differ even by a few hundreds of metres compared to WGS-84 coordinates. Both the systems are related by a transformation.

GPS measures distance (range) using travel time of radio signals. This in turn needs accurate timing, position of the satellite in space and to correct for any delays the signal experiences as it travels through the atmosphere. By accurately measuring the distance from three satellites, one can triangulate the position from anywhere on the earth. Satellites use atomic clocks.

Differential GPS (DGPS) is a system in which differences between observed and computed coordinates or ranges, known as differential corrections, at a particular known point called reference station, are transmitted to the user (Rover GPS receiver) in real-time to improve the accuracy of the user receiving position. Positional accuracies are less than 10 m. DGPS services currently available in India provide accuracies up to 10 cm.

GPS including DGPS is an all-weather, real-time, continuously available, economic, precise positioning and time-determination technique. Applications include military and police, navigation, aviation, surveys, geophysics, geology, mining, engineering, etc. Cost of a GPS receiver varies from a few hundred US dollars to US $30,000 (Rs 10,000 to 15 lakhs).

Different countries have employed different satellite navigational systems. GAGAN is the proposed Indian space-based augmentation system, jointly between ISRO and Airports Authority of India, to provide seamless navigation service for all the phases of flight over the Indian airspace.

Today, GPS is revolutionizing many fields, including surveying, automated vehicle tracking, municipal planning, etc. GPS provides accurate positional information to individuals and organizations around the world. This improves the quality of everything, from asset management to field workforce operations. Also, the US is proposing anti-jam capabilities. Recent development such as removal of selective availability has not merely made this technology more accurate, but has also opened up a new segment of applications, particularly in location-based services. In future, every one of our houses will be GPS-indexed, rather than have a house number.

The book under review by N. K. Agrawal is a short one of 145 pages, consisting of 97 pages of text and about 50 pages of articles/columns on GPS with references. It is a straightforward introductory text and can be used by any enthusiast of GPS who wants to know how the system works and what it can be used for. In each chapter, only essentials are given. Mathematically non-rigorous, starting with geodesy fundamentals in chapter 1, the book deals with the reference coordinate system, GPS, signal processing and GPS observables, error budget and corrections, differential GPS and GPS applications.

To my knowledge, there are no Indian books on GPS and Agrawal's book is the first. His knowledge and experience, both as a practitioner and as a teacher of GPS, is reflected in each of the topics. The narration is concise and straight to the point, rather than dealing with lots of theory and details. A list of questions at the end of each chapter is given for reviewing. For the first time we see in this book the transformation of coordinates from WGS-84 to Everest ellipsoid.

The articles and columns in this book provide interesting reading and give insight into various aspects of GPS besides revealing highly useful information, national and international.

Some interesting points are mentioned below:

The author has given details and inferences drawn from an experimental study with a hand-held GPS receiver called Garmin GPS Navigator. According to him, it can be used only for planimetry and not for height determination. Also,