not fundamental; the fundamentalists believe it is fundamental. I guess I'm an atheist.

There is just one small section of the book that I didn't follow. In a chapter entitled "What Do Physicists Mean by 'We Understand'?" Kane writes about the third and deepest level of understanding, which he calls "why understanding." I don't understand.

The Particle Garden a fine and lively book written by an opinionated particle theorist. But then all the best books are written by opinionated people.

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Experimentation: An Introduction to Measurement Theory and Experiment Design

D. C. Baird
Prentice-Hall, Englewood Cliffs, NJ, 1995. 216 pp. $21.67 pb ISBN 0-13-303298-1

Experimental Methods: An Introduction to the Analysis and Presentation of Data

Les Kirkup
John Wiley, Brisbane, Australia, 1994. 216 pp. $24.95 pb ISBN 0-471-33579-7

How do we introduce our students to the craft of experimental physics from the design of an experiment to the concluding paragraph in a written report? In many universities, we wait until after the introductory course. Students by then will have obtained a conceptual understanding of the implications of data and a basic grasp of the usefulness of graphs. They are then ready to learn to attach uncertainties to the numbers they calculate and the graphs they (or their computers) draw. The laboratory courses may have a component that can use a textbook on data analysis, or students may be expected to utilize such a book for self-instruction or reference. David C. Baird's *Experimentation* and Les Kirkup's *Experimental Methods*, although written for first-year college students in Canada and Australia, respectively, should satisfy this need.

Baird's book is the third edition of a text that I used in my junior-year laboratory course more than 30 years ago. It is the more complete of the two, including chapters on an approach to laboratory work, scientific thinking and experimenting, experiment design, and writing scientific reports, in addition to those that discuss uncertainty, statistics and least-square fitting. It is written in an informal, chatty style, and each chapter concludes with a selection of problems, to which answers are given at the back of the book. The index is complete and would be useful to a student seeking a specific technique or equation.

Kirkup's book has a very different look. Although the writing is also "friendly," it is more terse and to the point. Examples and exercises interrupt the text, urging readers to apply immediately what they have just read. There are also problems at the end of each chapter, and answers to both exercises and problems are given at the back of the book. A chapter covering an introduction to experimentation includes two very useful items: a brief outline of the stages of an experiment and a discussion of the uses of a lab notebook that includes a copy of a page from the author's own laboratory notebook. The section on report writing is both brief and complete and it concludes with a sample report and a challenge to the student to comment on and improve it.

Baird's first edition of *Experimentation* was written before the use of calculators or computers in the laboratory. The third edition includes a section on the use of a spreadsheet program, specifically Quattro Pro, to draw graphs and do regression analysis, and an example of the use of the program SlideWrite to fit various functions to a set of observations. But none of the exercises or problems he gives requires computer use. Kirkup, on the other hand, has a chapter on the use of a pocket calculator, with specific instructions given for the Casio fx-100 series. His chapter on the use of spreadsheets includes detailed instructions (for Excel 5.0) and examples. Kirkup also includes an appendix giving an overview of the use of microcomputers in gathering data. Similarly, many of Baird's references are the classics from the 1940s to the 1970s, while Kirkup's choices are more recent, are annotated and are linked to specific chapters.

Either book would be useful for students in laboratory courses, but for my own junior–senior laboratory course I would use Kirkup's book. I believe that students would be more likely to read his terse prose rather than Baird's more philosophical discourses, the exercises would provide avenues for class discussion while still leaving problems for homework, and the spreadsheet example could be copied and modified for use on the students' own experiments, leaving them with a reference book that would be useful in graduate school or an industrial laboratory.

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Oscillations in Finite Quantum Systems

G. F. Bertsch and R. A. Broglia
Cambridge U.P., New York, 1994. 212 pp. $49.95 hc ISBN 0-521-41148-3

Oscillations in Finite Quantum Systems is a very interesting book. In it George F. Bertsch and Ricardo A. Broglia emphasize that finite systems have common characteristics that are independent of the nature of the interaction between the constituent particles. Two systems are compared: the nucleus and metallic clusters. Quantum dots, which are not considered in this volume, also exhibit phenomena closely related to those seen in nuclear reactions. Magic numbers, deformation, giant resonances and fission, which have been thoroughly investigated by nuclear studies, are seen in metallic cluster experiments.

It is no surprise that the theoretical concepts and methods developed during the last 50 years by nuclear physicists are exploited by theorists in their description of the properties of metallic clusters. There is, however, a fundamental difference between nuclei and clusters. The number of particles in a nucleus is limited to a few hundred (except in neutron stars), while clusters of neutral atoms have been produced with as many as several thousand atoms. For these very large clusters, solid state properties begin to appear. We are thus presented with the exciting prospect of studies that trace the properties of clusters from a regime where nuclear-like properties dominate to one in which condensed-matter characteristics are exhibited.

As the authors point out, complex many-body systems can exhibit simple behavior, and these "simple" states are most readily discovered experimentally rather than by solving the many-body Schrödinger equation.

This book focuses on oscillations, including dipole oscillations, surface and compressional modes and spin modes. These reveal themselves experimentally as resonances whose position and width depend of course on the characteristic dynamics prevailing in each system. But the overall perspective is independent of that specificity. In both cases (nuclear and cluster) the quantum theory of oscillation begins with the mean field and then goes on to the random phase approximation. Concepts like the response function are introduced. The quantum discussion is often prefaced by classical considerations (using, for example, the liquid drop model), which are generally helpful in developing an intuitive grasp of the phenomena involved.

This is a successful book. It can be read as an introduction to the field, although considerable effort will be required of serious readers if they wish to follow the details of the theoretical developments presented. A knowledge of nuclear theory would be very helpful, but in any event, a clear picture emerges: Oscillations of a finite system, whether that of a nucleus or of a metallic cluster, have many phenomena in common, and common methods are employed for their explanation.

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The Creation of Scientific Effects: Heinrich Hertz and Electric Waves

Jed Z. Buchwald
U. of Chicago P., Chicago, 1994. 482 pp. $75.00 hc ISBN 0-226-07887-6; $32.95 pb ISBN 0-226-07888-4

If you want to read history of science the way it should be written, with careful attention to technical detail, valuable discussion of the scientific context and interesting personal glimpses from diaries and letters, then Jed Buchwald's *The Creation of Scientific Effects* is for you. Using published work, laboratory notebooks, diaries and letters, Buchwald reconstructs the history of the work of Heinrich Hertz from his days as a student to his work in Hermann Helmholtz's laboratory through his 1889 experiment demonstrating the interference, and thus the existence, of electromagnetic waves.

All contemporary physicists "know" that Hertz tested Maxwell's prediction of electromagnetic waves and, by demonstrating their existence, gave support to Maxwell's theory of electromagnetism. Buchwald shows, however, that Hertz's experiment had very different origins and that it was only at the very end of the sequence of experiments that he even began to