power series, and he can learn about Padé approximants when and if he specializes in the field. My first reaction to the material on "graphology" in Part IV was that this also went beyond the scope of the book; but it is presented well and does illustrate some important physics. Much of Part VI, dealing primarily with transport properties, is likewise too detailed to be consistent with the remainder of the book. It is drawn in part from very recent research that has not yet stood the test of time, and that to some extent is already outdated.

I would have been even more pleased than I am with this book if a considerable fraction of Parts IV and VI had been omitted, if a small portion of this space had perhaps been allocated to a brief but systematic account of the history of the field and if the remainder of the available space had been occupied by a separate section dealing with critical phenomena in other systems. The language used by the author is primarily that appropriate to magnetic systems. I do not object to this; but the equivalences and differences between order–disorder, liquid–gas, antiferromagnetic, ferromagnetic, liquid mixture, and superfluid transitions should have been discussed somewhere in this volume.

The book is rather uneven in another respect as well. The initial chapters contain almost no references, which is fine for an introductory text. Unfortunately, the few references that do exist are sometimes inappropriate. Thus, figures displaying the measurements by J. Anthony Tyson and David H. Douglass, Jr of the superfluid density of He II and the specific heat results for cobalt chloride of J. Skalyo and S. A. Friedberg are labeled "after Kadanoff *et al.*" This reference pertains to a review article, and no credit is given to the experimentalists responsible for the data. In Parts IV and VI, original literature citations are extremely plentiful; this is unnecessary in an elementary text and not in keeping with the earlier chapters.

It is not clear to me what audience the author primarily had in mind. Because of its uneven character, the book is perhaps more suitable for beginning graduate students who wish to specialize in this field than it is for a formal course given to a more general audience. However, for the latter purpose it still contains much well written material; but it omits some that should be included and includes some that should be omitted.

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Invisible Colleges: Diffusion of Knowledge in Scientific Communities

Diana Crane
The Univ. of Chicago Press, Chicago, Illinois, 1972. $9.00

Much of Diana Crane's work over the past decade of so has dealt with the communication system in science and more generally with various aspects of the sociology of science. Her central focus in this volume is on scientific communities and how scientific knowledge is produced. For her, the problem is to identify these communities, to determine whether there are truly communities or invisible colleges or "social circles"—each implying quite different connections among the scientists. Crane does this directly through a sociometric analysis of who says they are influenced by whom, and, indirectly through an analysis of citation patterns in the literature of a given field. Thus a tightly knit cluster of papers is taken to reflect a tightly knit group of scientists engaged in producing new knowledge.

Taking off from Thomas S. Kuhn's work on normal and revolutionary science and the role of the paradigm, Crane seeks to combine stages in the growth of knowledge with differing characteristics of scientific communities. Thus when a paradigm first appears in a given field, she postulates that there is little or no social organization. But as the paradigm becomes adopted and normal science progresses, groups of collaborators and even invisible colleges develop. Major problems are getting solved. Eventually anomalies appear. Scientists have become increasingly specialized, and at the same time there is more controversy. Finally, there is exhaustion and crisis and a concomitant decline in community membership. The curve of publications flattens out after having taken off in the second stage and crested in the third. Many people presumably go off to work in greener fields.

In developing this model of scientific growth, Crane is not wholly unaware of the role of cognitive and substantive differences among scientific subfields. But her emphasis is on the role of social organization (a factor often neglected or ignored) as it promotes the development of subfields, aids in the diffusion of knowledge and even in the choice of problems. The interrelations of patterns of growth and patterns of social organization are explored. And the whole communication system within science is examined not only in terms of internal efficiency but in terms of the model she has developed.

In the final chapter, Crane takes

some halting steps toward the development of a theory of culture. Despite obvious substantive differences in science, art, literature and other components of culture, Crane feels that there are sufficient similarities in their "modes of social and ideational development" to merit looking at all of them from the same theoretical perspective. The key for Crane is that all are characterized by "cumulative growth punctuated by periodic discontinuities."

Interesting and provocative as these ideas may be, they are, to my mind at least, somewhat premature. Nothing in this volume convinces me that we already know enough about the sociology of science—even in the limited way in which she has defined it. Whether developing a general sociology of culture is more likely to accelerate or enhance our understanding of science in its own right also remains to be seen.

But these are issues best elaborated in sociological communities, invisible colleges and "circles." Many physicists may find this book of interest—particularly much of the discussion in chapter 6 on some of the conditions facilitating the transmission of ideas especially in the interaction between scientific communities.

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Introduction to Particle Physics

Roland Omnès; G. Barton, trans.
414 pp. Interscience, New York, 1971. $18.50

In a currently developing field such as particle physics the problems of a textbook writer are perennial. Ideally he must present the established material that lays the foundation for a student's study and also give an account of current activity that indicates new directions in the subject. Some authors concentrate on the former task and present an encyclopedic survey of standard material, and leave the newer developments to conference proceedings and to journals.

In his book, *Introduction to Particle Physics,* Roland Omnès seeks to cover both the established and the current. He does this by dividing the text into two distinct parts and by aiming at a deliberate contrast between the topics treated in each. Part I he calls the "grammar" of the subject, and Part II the "guide to the literature."

Thus Part I begins with a broad survey at a level that includes sketches of a cyclotron, snychrotron, linear accelerator, and a bubble chamber and goes on to topics such as conservation laws, group theory, collision theory, and resonances. A good many matrices are written out explicitly (a factor that seems to have become a measure of the sophistication of a work). The treatment in this section is largely pedagogical and generally elementary. On the other hand, chapters 4 and 10 constitute a far more advanced discussion of relativistic kinematics using the Poincaré group and the derivation of the Dirac equation from this point of view.

The introduction to Part II promises to "present a relatively complete panoramic view of the many different aspects of particle physics, and to be deliberately superficial. . . ." The topics covered are quantum electrodynamics, strong interactions, SU(3), Regge poles and weak interactions. As usual, such a survey is inevitably biased toward the author's own interests, and Omnès, who is co-author of *Mandelstam Theory and Regge Poles,* is no exception.

The division into parts I and II is