ter, it should have been possible to produce a decent version of Krinov's book in much less than a year. The present version is a disgrace to the Western publishing trade, and an affront to the author as well.

Elements of the Theory of Markov Processes and Their Applications. By A. T. Bharucha-Reid. 468 pp. McGraw-Hill Book Co., Inc., New York, 1960. $11.50. *Reviewed by Philip M. Morse, Massachusetts Institute of Technology.*

NEW developments in classical theory, as if in response to quantum theory, are to a great extent concerned with the effects of random events. The scattering of sound and of electromagnetic waves from the inhomogeneities caused by turbulence, the details of Brownian motion and of thermal noise, and the build-up of cosmic-ray showers are examples of stochastic processes. And here the interconnections with other scientific disciplines are particularly fertile. The astrophysics of galaxies parallels the theory of plasmas. The theory of cosmic-ray cascades is very close to that of the rise of disease epidemics. And the mathematical techniques used in the statistical theory of radioactive decay are the same as those used in the study of the growth and decline of animal populations, the fluctuations of automobile traffic, and the flow of goods inventories. It is time that a book on the basic theory and its various applications was published in this country.

The simplest stochastic processes, roughly analogous to the linear processes in field theory, are the Markov processes, where the statistical behavior of the system in each successive period of time is determined by the state of the system at the beginning of the period. Many of the processes just mentioned can be adequately represented by a Markov process, or can be related to one, as a first approximation.

The book under review presents a logical and readable account of the basic theory of Markov processes and discusses the application of the theory to these and other aspects of physics, chemistry, biology, and operations research.

The chapters on basic theory discuss the simple Markov process, with denumerable system-states and discrete time periods. They then go on to the cases of continuous time and the further extension to continuous space variables, and conclude with diffusion and Fokker-Planck equations. The part on applications touches on biology, and gives an introduction to the genetic theories of R. A. Fisher and of Sewell Wright, and a short treatment of stochastic theories of ecology and epidemiology. The discussion of the applications in physics is more detailed. It includes a chapter on cascade processes and another on the statistics of particle counters and of nuclear fission. The chapter on astrophysics concentrates chiefly on galactic fluctuations. The latter part of the book deals with the statistics of chemical kinetics, and applications in operations research, dealing mainly with queuing. Appendices on

Increased technical responsibilities in the field of range measurements have required the creation of new positions at the Lincoln Laboratory. We invite inquiries from senior members of the scientific community interested in participating with us in solving problems of the greatest urgency in the defense of the nation.

RADIO PHYSICS and ASTRONOMY

RE-ENTRY PHYSICS

PENETRATION AIDS DEVELOPMENT

TARGET IDENTIFICATION RESEARCH

SYSTEMS: Space Surveillance • Strategic Communications • Integrated Data Networks

NEW RADAR TECHNIQUES

SYSTEM ANALYSIS

COMMUNICATIONS: Techniques • Psychology • Theory

INFORMATION PROCESSING

SOLID STATE Physics, Chemistry, and Metallurgy

- *A more complete description of the Laboratory's work will be sent to you upon request.*

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

Research and Development
LINCOLN LABORATORY
Massachusetts Institute of Technology
BOX 15
LEXINGTON 73, MASSACHUSETTS

generating functions, Laplace and Mellin transforms and on Monte Carlo methods, complete the book.

The style is clear, the index is adequate, the cross-references are numerous and the bibliographies are fairly complete. This is a welcome addition to one's library.

X-Ray Microscopy. By V. E. Cosslett and W. C. Nixon. 406 pp. Cambridge U. Press, New York, 1960. $15.00. *Reviewed by H. A. Liebhafsky, General Electric Research Laboratory.*

THE growing use of x rays to procure information about matter nowadays yields its most spectacular results in applications where the volume from which the x rays originate (x-ray emission methods) or in which they are attenuated (x-ray absorption methods) is as small as is feasible. *X-Ray Microscopy,* is an authoritative, badly needed treatment of the methods by which these spectacular results are won.

Of course, the title must not be taken too literally. Not all of the devices described are microscopes, and no one has yet built an x-ray device in which the resolving power approaches that promised by the short wavelengths of the rays. Chapters 4 and 5 show what has been done to focus x rays by specular and by Bragg reflection. Roentgen's view concerning the difficulty of focusing x rays with lenses is still sound, but he might have been surprised to learn that the total reflection of x rays is possible near grazing incidence, that it occurs outside the solid, and that aberration can be satisfactorily reduced by suitable reflection.

Enlargement via this route, though the subject of many admirable investigations, is not yet of much practical value. But, as the set of 32 beautiful plates shows, two highly useful methods are commonly included under x-ray microscopy: contact microradoigraphy (Chapter 2) and point projection with x rays (Chapter 3). The former method is old and relies on the optical microscope for the magnification; radiography thus becomes microscopy. The latter method requires a fine-focus x-ray source of high intensity, and here the authors have made major contributions, a landmark among which is the attaining of a spot diameter near 0.1 micron and a useful magnification exceeding 2000. These small x-ray sources are an important further consequence of the electron lens development that led initially to the electron microscope.

Even before electronics grew to its present importance in x-ray detection, information about composition in localized regions was being extracted from photographic plates. The work of Engström and his school is a notable example in the life sciences, to which the methods in the book may ultimately make their most significant contributions. The fine-focus x-ray tube now makes it practical to use electronic means of x-ray intensity measurement to obtain information on this scale not only about composition by x-ray absorptiometry (Chapter 6) and by x-ray emission spectrography (Chapter 7) but also about crystal structure by dif-