opment (as in the roots of the field) to physical models. Having developed an appetite from this text, readers will be able to branch out and study more thoroughly many different and important aspects of the theory and applications of stochastic differential equations.

The first chapter provides a rapid review of probability theory and includes meaningful and challenging exercises; the second introduces Langevin's equation, the backward and forward equations for a random process, and convergence to Brownian motion; the third motivates the need for a stochastic calculus and develops the Ito and Stratonovich integrals and stochastic differentials; the fourth chapter integrates linear equations, including that for the Ornstein–Uhlenbeck process, and discusses Markov and diffusion processes. The tie-up between stochastic differential equations and partial differential equations comes principally through Kolmogorov's formula. This is explored in Chapter 5, where coverage includes the Feynman–Kac formula, the Fokker–Planck equation, various boundary conditions, exit times and exit points, and the stability of stochastic differential equations.

Chapters 6 through 9 emphasize the asymptotic analysis of stochastic and applications. The sixth chapter explains the Smoluchowski–Kramers approximation for a particle in a force field and the diffusion approximation for Markov chains; the seventh discusses exit time problems with small diffusion and the related singular perturbation theory for elliptic equations, including expansions for the first eigenvalue problem. Chapter 8 contains a diffusion model of chemical reactions based on an analysis of the appropriate potential barrier and a discussion of atomic migration in crystals; and Chapter 9 discusses a variety of applications and new results for filtering signals in noisy channels. These later chapters cleverly take full advantage of the author's experience and expertise in partial differential equations and related parts of analysis.

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Giant Resonance Phenomena in Intermediate-Energy Nuclear Reactions

F. Cannata, H. Überall
112 pp. Springer, New York, 1980. $29.80

This short monograph summarizes in a rather succinct manner years of effort by two of the more prolific practitioners of the art of applying the Helm and generalized Goldhaber–Teller models to the analysis and interpretation of data from such diverse sources as the inelastic scattering of electrons, hadrons, pions and neutrinos, muon capture, radiative pion capture and pion photoproduction.

Within the framework of Eugene Wigner's supermultiplet theory Francesco Cannata and Herbert Überall have provided a concise summary and description of the theory of giant resonance states and their excitation by operators having various properties in spin and isospin space. These operators are associated with the probes used to study nuclear structure. The theory results in prescriptions that relate sets of empirical data obtained using photons, leptons, mesons and hadrons to each other. Unfortunately the authors insufficiently discuss the validity and limitations of the models mentioned or the problems that exist in extracting nuclear properties from experimental data. One such problem is that for inelastic electron scattering data in the continuum region there are 20% uncertainties in the radiative tail correc-

tion. In addition, nuclear models have to be used to analyze the data. Different models result in strengths for a given transition that can differ by as much as a factor of 2.

The monograph appears to have been produced directly by photocopy from material provided by the authors. It suffers from having a rather large number of deficiencies that could have been caught and corrected by careful copy-editing. These include the presence of only one reference list when two systems of reference notation are used, words with missing letters, missing symbol definitions, sentences that refer back to statements or terms in equations that do not exist and a figure with at least two misprints on the energy scale.

For someone working in the field this monograph provides a good brief summary of the theory of the excitation of giant resonance states by a wide range of probes. Unfortunately the discussion is limited almost exclusively to one model and no attempt is made to present a critical review of either the theoretical or experimental aspects of the field. As a result, a somewhat superficial picture emerges of the successes and failures of theory to synthesize the wide body of data that exists. Someone not working in—or close to—the field could very well come away from this book with a somewhat distorted picture of our present state of knowledge on the nuclear giant resonances.

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Theories of Spectral Line Shape

R. G. Breene Jr.
344 pp. Wiley, New York, 1981. $32.95

The subject of spectral line shape in gases is an old one, but it has enjoyed a renaissance during recent years, partly due to enormous improvements in the techniques of high resolution spectroscopy. The scope of the problem is fairly wide—from the microwave spectrum to ultraviolet, and from the linear response of a weak exciting field to nonlinear phenomena. Obviously, it would be difficult to cover the entire field in a single volume. While the literature on this subject has grown rapidly during last 20 to 30 years, very few books have been published in this area. *Theories of Spectral Line Shape* fills part of the gap by presenting the recent theoretical developments in the linear regime. It primarily deals with neutral monatomic gases. It considers neither applications to molecular gases and plasmas nor line shapes in light scattering. The author is well known from his earlier (1961) book *The Shift and Shape of Spectral Lines.* The more recent books on the subject—*Plasma Spectroscopy* (1964) and *Spectral Line Broadening by Plasmas* (1974), both by H. R. Grien—primarily deal with plasmas.

The presentation here consists of summaries of selected works together with appropriate introductions. Three general techniques that have gained prominence in line shape theory are emphasized. These techniques are based on resolvent operators, Liouville spaces, and Feynman diagrams and Green's functions. In these discussions the author has attempted to introduce the theoretical techniques without going into the details of rigorous mathematical developments.

After an introduction that provides a good overview of the field, the book opens with a chapter on natural line broadening caused by the interaction of an atom with its own electromagnetic field. The next four chapters develop the necessary theoretical framework and present various theories of line