

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 opera-

tors 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-

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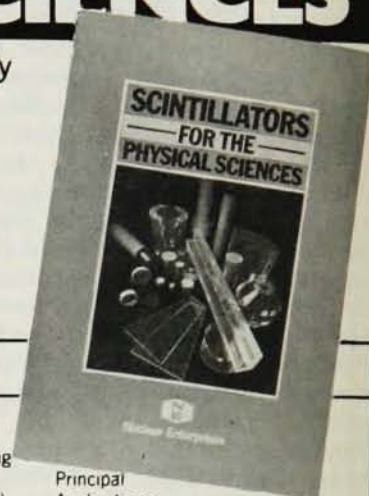


TABLE OF PHYSICAL CONSTANTS

	Scintillator	Type	Light Output (% Anthracene)	Decay Constant, Main Component ns	Wave-length of Maximum Emission nm	Content of Loading Element (% by wt.)	Principal Applications
PLASTIC	NE 102A	Plastic	65	2.4	423	.....	γ , α , β , fast n
	NE 104	Plastic	68	1.9	406	.....	ultra-fast counting
	NE 104B	Plastic	59	3.0	406	.....	with BBQ light guides
	NE 105	Plastic	46	.....	423	.....	dosimetry
	NE 110	Plastic	60	3.3	434	.....	γ , α , β , fast n, etc.
	NE 111A	Plastic	55	1.6	370	.....	ultra-fast timing
	NE 114	Plastic	50	4.0	434	.....	as for NE 110
	NE 160	Plastic	59	2.3	423	.....	use at high temperatures
	Pilot U	Plastic	67	1.36	391	.....	ultra fast timing
	Pilot 425	Plastic	.....	.....	425	.....	Cherenkov detector
LIQUID	NE 213	Liquid	78	3.7	425	.....	fast n (P.S.D.)
	NE 216	Liquid	78	3.5	425	.....	α , β (internal counting)
	NE 220	Liquid	65	3.8	425	0.29%	Internal counting, dosimetry
	NE 221	Gel	55	4	425	.....	α , β (internal counting)
	NE 224	Liquid	80	2.6	425	.....	γ , fast n
	NE 226	Liquid	20	3.3	430	.....	γ , insensitive to n
	NE 228	Liquid	45	.....	385	.....	n
	NE 230	Deuterated liquid	60	3.0	425	D 14.2%	(D/C) special applications
	NE 232	Deuterated liquid	60	4	430	D 24.5%	(D/C) special applications
	NE 233	Liquid	74	3.7	425	.....	α , β (internal counting)
	NE 235	Liquid	40	4	420	.....	large tanks
	NE 250	Liquid	50	4	425	0.32%	internal counting, dosimetry
LOADED LIQUID	NE 311 & 311A	B loaded liquid	65	3.8	425	B 5%	n, β
	NE 313	Gd loaded liquid	62	4.0	425	Gd 0.5%	n
	NE 316	Sn loaded liquid	35	4.0	425	Sn 10%	γ , X-rays
	NE 323	Gd loaded liquid	60	3.8	425	Gd 0.5%	n
NEUTRON (ZnS-type) and GLASS	NE 422 & 426	$^6\text{Li-ZnS(Ag)}$	300	200	450	Li 5%	slow n
	NE 451	ZnS(Ag)-plastic	300	200	450	.....	fast n
	NE 901, 902, 903	Glass	28	20 & 60	395	Li 2.3%	n, β
	NE 904, 905, 906	Glass	25	20 & 58	395	Li 6.6%	n
	NE 907, 908	Glass	20	18 & 62	399	Li 7.5%	n
	NE 912, 913	Glass	25	18 & 55	397	Li 7.7%	n, β (low background)

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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.

EVERETT FULLER

National Bureau of Standards

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. Griem—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

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