

Book Review: *Dynamic Light Scattering: Applications of Photon Correlation Spectroscopy*

Dynamic Light Scattering: Applications of Photon Correlation Spectroscopy.
Edited by Robert Pecora (Plenum, New York, 1985).

This volume contains 10 carefully chosen chapters on specialized topics relating to applications of photon correlation spectroscopy. The subjects of particular interest to the readers of this Journal are those dealing with polymer structure and dynamics (K. Zero and R. Pecora; D. W. Schaefer and C. C. Han), interactions between dispersed particles (P. N. Pusey and R. J. A. Tough), viscoelastic properties of bulk polymers (G. D. Patterson), micellization of amphiphilic molecules (N. A. Mazer), critical phenomena (B. Chu), and collective behavior of polymer networks (T. Tanaka). In addition, there is an excellent chapter on instrumentation and experimental methodology (N. C. Ford, Jr.), and a comprehensive review of biological applications (V. A. Bloomfield).

In their chapter on dynamic light scattering from suspensions of strongly interacting charged particles (Chapt. 4), Pusey and Tough indicate in detail how hydrodynamical and statistical mechanical theories are invoked to interpret acquired data. Central to the analysis is the formulation and solution of a generalized Smoluchowski equation, and the authors expound upon the interesting and complex mathematical manipulations that are required. In the same spirit, in a chapter on scattering from dilute and semidilute polymer solutions (Chapt. 5), Schaefer and Han relate experimental data to various theories of polymer conformation and dynamics. Photon correlation spectroscopy provides data needed to substantiate recent theoretical advances based on scaling methods, renormalization concepts, and other modern developments. Chapters 4 and 5 are the longest, constituting more than one third of the text.

In his chapter on critical phenomena (Chapt. 7), Chu touches upon the use of small angle X-ray and neutron scattering to measure static critical behavior in gases and multicomponent fluids. However, he primarily discusses dynamical critical behavior and indicates how line widths can be explained in terms of mode-mode coupling theory and renormalization group dynamics. Emphasis is on relating experimental observations to theoretical analyses which, however, are detailed elsewhere.

The use of Fabry–Perot interferometry to measure entropy fluctuations also is discussed.

Fabry–Perot interferometry is described in greater length by Patterson in a chapter on dynamic light scattering from bulk polymers (Chapt. 6), where it is shown how Rayleigh–Brillouin spectroscopy can be combined with photon correlation spectroscopy to provide information about the dynamics of the glass transition. Included is a discussion of depolarized Rayleigh scattering. The chapter contributed by Zero and Pecora contains a review of dynamic depolarized light scattering (Chapt. 3), with the theoretical basis of this technique outlined and its application to studies of macromolecules discussed. Line widths are related to the rotational diffusion constant, which is very sensitive to the size and shape of the scatterers. In principle, internal segmental motions and interactions between macromolecules in semidilute solutions can be investigated with this method.

The phase behavior of complex media is highlighted both in Mazer's chapter on micellar systems (Chapt. 8) and Tanaka's chapter on polymer gels (Chapt. 9). These subjects contain attractive challenges for theoreticians and, as the authors amply demonstrate, quasielastic light scattering affords new opportunities for obtaining pertinent data. N. C. Ford's chapter on basic technique (Chapt. 2) is an intelligent introduction to the subject of quasielastic light scattering and should facilitate subsequent reading of the literature. Finally, the comprehensive chapter by Bloomfield on biological applications (Chapt. 10) is an excellent source of information for the adventurous reader who might wish to start exploring other areas in which statistical physics clearly has a role.

The message is clear: Photon correlation spectroscopy is a powerful technique, useful for investigating structure and interactions in many areas of condensed matter physics where interpretation of experimental data relies heavily upon modern theories of statistical physics. Theoreticians should find *Dynamic Light Scattering* to be a good source of information about modern light scattering investigation into phenomena involving polymers and their interactions. Experimentalists who are curious about progress being made in fields other than their own particular specialties also should find this compilation to be informative. The editor indicates that this book is the first of a series, and one can look forward with pleasure to the appearance of subsequent volumes.

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