Journal of Statistical Physics, Vol. 35, Nos. 5/6, 1984

Book Review: *Measurement of Suspended Particles by Quasi-Elastic Light Scattering*

Measurement of Suspended Particles by Quasi-Elastic Light Scattering, Edited by Barton E. Dahneke.
(Wiley Interscience, New York, 1983).

Quasielastic light scattering, also known as inelastic or dynamic light scattering, or photon correlation or intensity fluctuation spectroscopy, has been developed over the last 15 years as a powerful tool for measuring important parameters in many areas of physics, chemistry, and biology. Fluctuations in the intensity of scattered light are detected and their time correlations and other statistical properties yield information about the underlying kinematics of the scattering medium. Techniques have been devised to study, for example, such diverse phenomena as the translational and internal motions of macromolecules, the thermal excitations of polymer networks, the beating of cilia, the structure of microemulsions, the surface charge of biological cells, and the swimming of microorganisms.

The fundamental data which are provided are inherently statistical in character. Even when a relatively simple system is examined, for example an ideal monodisperse collection of noninteracting macromolecules (Brownian particles), mathematically interesting questions arise concerning the dependence of inferred kinematic parameters (in this case the diffusion coefficient) on such statistical variables as sampling time, intensity of scattered photons, duration of the scattering experiment, and the characteristics of the signal analyzer. Because the useful autocorrelated signal of photocounts rests above an "uncorrelated background" which itself contains statistical fluctuations, much sophisticated work has gone into examining the statistical characteristics of experimental estimators of theoretical models for photon autocorrelation functions.

Recent theoretical emphasis has been directed to the problem of inversion: for example, given a heterogeneous collection of scatterers, what information about their size distribution can be obtained from the measured autocorrelation function which, in principle, is a sum of exponentials

0022-4715/84/0600-0765$03.50/0

whose weights are related to the scattering power of the corresponding molecular species? Several excellent papers in this book discuss this and related problems. One, for example, concerns exponentially sampled autocorrelation functions, in which a generalization of the Nyquist sampling theorem is used to estimate the limits on the resolution of particle size distributions. Other papers on size distribution analysis contain discussions of various schemes for inverting data, including spline and histogram analyses, and generalized Laplace inversion techniques. Indeed, a complete overview of procedures currently used for data analysis in this subject can be obtained from those papers and the references quoted therein. The book also contains two introductory chapters in which the basic theory and practice of correlation spectroscopy is reviewed. A particularly attractive feature, moreover, is the inclusion of several chapters on specialized applications which show the nature of the statistical mechanical modeling which is invoked in these endeavors.

This book provides a useful introduction to quasielastic light scattering and several ancillary techniques, particularly for those readers who are curious about statistical problems related to data analysis. It contains 20 chapters in total, contributed by different research groups. Consequently, the specialist also will find useful articles on some previously unfamiliar topic.

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