Book Review

Laser Light Scattering by C. S. Johnson, Jr. and D. A. Gabriel

Dover Publications, Inc., New York, 1995. 96 pages, $6.95 (paperback)

Reviewed by Victor A. Bloomfield, Department of Biochemistry, University of Minnesota

Light scattering has been a prominent tool for characterizing polymers and biopolymers since the 1940's, but the development of intense, coherent lasers, sensitive photodetectors, and efficient correlators and spectrum analyzers gave it new impetus beginning in the mid- to late 1960's. Classical, total intensity scattering became more sensitive and versatile, and diffusion and other dynamic processes in solutions of biological macromolecules can now be studied experimentally by light scattering spectroscopy.

Introducing new users to the concepts, theory, experimental methods, and data analysis procedures of modern light scattering is not a trivial issue. Sophisticated light scattering instruments can now be bought as turnkey instruments, and it is all too possible to obtain results without understanding their source or limitations. On the other hand, there are a number of books that explain classical and modern light scattering in depth and detail, but those just entering research may not want or need such a full treatment.

The aim of the book under review is to provide an introduction to both total intensity and dynamic (quasielastic) forms of light scattering. It is a re-publication, in standard Dover paperback format, of a long chapter originally published in Vol. II of *Spectroscopy in Biochemistry*, edited by T. Ellis Bell (CRC Press, Inc., 1981). A brief preface brings the listing of relevant monographs up to date, but otherwise it is an unchanged reprint of the 1981 chapter.

In 96 packed but readable pages, it covers most of the important topics. For classical light scattering, the treatment is similar to Chapter 5 of Tanford's *Physical Chemistry of Macromolecules*, which many of us have relied on for a basic treatment, but which is now out of print. This section covers in 20 pages the dependence of intensity on molecular weight and refractive index increment, concentration, size, shape, and polydispersity. The section on dynamic light scattering is somewhat longer, as befits the greater diversity and theoretical subtlety of the material. It covers time and frequency dependence, translational diffusion, directed flows (including electrophoretic light scattering), rotational motion, motility, number fluctuations, and chemical reactions. A set of appendixes provides a concise summary of the theoretical background—electromagnetic theory, chemical potentials and virial expansions, correlation functions, cumulant analysis, and diffusion theory—allowing the main text to flow without overwhelming complexity.

When the text of this book was written 15 years ago, most of the basic experimental and theoretical developments of laser light scattering were already in place. Many of the fundamental monographs cited in the 1981 review are still the references of choice, and the most important newer ones are listed in the Preface. A few recent developments are missing, such as computer-intensive and hard-wired methods for characterizing distributions of relaxation times (e.g. Provencher's CONTIN and DISCRETE, maximum entropy, and multi-tau analysis). The description of correlators and photodetectors is somewhat out of date, and very low angle light scattering detectors are now in common use. Internal modes in polymers and gels are not treated. But most of the fundamentals are here.

This is a compact, efficient, and useful book. To read it will require close attention, with a background in physics, physical chemistry and mathematics appropriate for beginning graduate students in biophysics or biophysical chemistry. If a new graduate student or postdoc joins my lab to do light scattering research, this is the book I will recommend to give them the basics in a reasonable period of time. And at $6.95, they can afford their own copy.