grangian, with its horrid tangle of typefaces and indices, may know what I mean)." Perhaps my disagreement about the beauty of the mathematics, or lack thereof, is at the root of my feeling that the verbal arguments one must present to get around the mathematics can frequently be more convoluted and confusing than the mathematics itself.

In spite of my reservations, this is a noble effort, and I am sympathetic to its motivating theme. Icke argues that "what gets in our way is that the concepts are unusual, not that they are extremely difficult." It is frustrating when reviewers of popular physics literature confuse arguments that are unusual or new with arguments that are difficult. There is a feeling that if you have to think about a scientific argument—as distinct from, say, an economic or philosophical one—it is too difficult to bother worrying about. To the extent that this book supports the effort to show that a sufficiently motivated novice can appreciate the intricacies of many of the ideas at the forefront of physics, I applaud it. We can all hope that the idea catches on.

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Laser Experiments for Beginners

Richard N. Zare, Bertrand H. Spencer, Dwight S. Springer and Matthew P. Jacobson
University Science Books, Sausalito, Calif., 1995. 232 pp. $26.50 pb ISBN 0-935702-36-9

The literature on lasers is large, rapidly growing and impressive, reflecting the rather substantial influence of this tool in science and in society. *Laser Experiments for Beginners*, by Richard N. Zare, Bertrand H. Spencer, Dwight S. Springer and Matthew P. Jacobson, aims to fill a relatively rarefied niche within this vast literature. The authors have designed a simple experimental program targeted at high school seniors and college undergraduates and intended to excite students and expose them to the laser and its applications.

I enjoyed working through this book. The program is organized around three general phenomena associated with light: scattering, refraction and spectroscopy. The choice of experiments is dominated by studies of soft condensed-matter systems and chemical dynamics. There are light-scattering experiments probing colloids, emulsions and gels; there are experiments probing the time evolution of conventional chemical reactions; and there are experiments on photoinduced chemical dynamics. In some experiments, such as laser light diffraction from colloidal crystals, the behavior of light is the central theme of the measurement, while in other cases, such as column chromatography, the refraction of laser light is used as a tool to reveal other physical phenomena. Though many topics in laser physics are absent, the chosen experiments will be sufficient to excite the students and expose them to the laser.

There are five major chapters: scattering from disordered systems, diffraction from ordered systems, refraction, electronic structure of matter and photochemistry. Each chapter begins with a short, introductory section that uses simple models to elucidate the theory needed to understand the experiments of that chapter. These introductory expositions are a strong point of the book. The discussions are very clear. Each experimental write-up also has a supplementary discussion that further clarifies the ideas of that particular measurement.

The experiments are concept oriented and generally quite simple, with straightforward, step-by-step instructions. The authors also provide a useful grading of the experiments in terms of their conceptual and technical difficulty. With instructor assistance, high school students can probably do the easier experiments, but generally I think the book is better suited for college freshmen and sophomores. Experiments utilize low-power helium-neon lasers, store-bought chemicals and inexpensive optical components such as polarizers, mirrors and sample cells. The first chapter of the book is devoted to important details, such as safety equipment and equipment costs and manufacturers.

Among the most interesting experiments to physicists are those connected with colloids, emulsions and gels. These experiments exploit simple optical effects to measure the instabilities of complex fluids. Thus experimenters gain exposure to some fascinating materials as well as the means to study these systems. Later sections, on fluorescence spectroscopy and photochemistry, provide stimulating introductions to chemical physics. These experiments teach students about energy levels, and it is at this point that a more extensive discussion of lasers is finally provided.

Overall, I heartily recommend this book as a source of experiments and ideas for those of us teaching optical physics and chemistry to undergraduates. The combined experimental and theoretical approach that the book offers is not common, and I think it is likely to have a very positive effect on students through the sense of scientific adventure it engenders.

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Algebraic Theory of Molecules

Francesco Iachello and Raphael D. Levine
Oxford U. P., New York, 1995.
243 pp. $59.95 hc
ISBN 0-19-508091-2

Here, in a thorough and straightforward style, is the full current story of the algebraic method of describing and analyzing molecular rotation–vibration spectra. This approach is based on expressing the Hamiltonian of the system in powers of the creation and annihilation operators of the degrees of freedom in which the Hamiltonian is cast. Francesco Iachello, Raphael D. Levine and their colleagues have been developing these ideas for over 12 years, as they point out in their preface. When the first papers appeared, some spectroscopists asked why they should pay attention to this new method, since the traditional phenomenological methods had been so successful. *Algebraic Theory of Molecules* should settle the question.

The first chapter reviews the quantum mechanical description of diatomic molecules, familiar to molecular spectroscopists but not, in this depth, to most other readers. The second chapter and the appendices lay the basis of the algebraic theory and of Lie algebras, which are familiar to a different part of the audience but not to molecular spectroscopists. For the spectroscopist, this chapter shows familiar material in a form very different from the traditional and should be the basis for crossing into the new approach. Then the book goes into polyatomic molecules, with a brief general excursion into the mechanics of polyatomics, followed by a full development, so far as it has gone, of triatomic, (linear) tetratomic and many-body systems in successive chapters. The seventh chapter explores the connection between quantum algebraic theory and the classical limit, including mean-field approaches. A short, concluding chapter tantalizes the reader with subjects less developed, such as scattering problems and coupling of electronic and vibrational degrees of freedom.

Algebraic Theory of Molecules provides a number of comparisons of results of traditional phenomenological descriptions and their algebraic theory