ordered sub-routines of most computer programs" (p. 17).

Vickers is a pleasant and learned guide to the history of his subject since the publication of Fechner's *Element der Psychophysik* in 1860 and his enthusiasm for historical detail and quotation is engaging. However this would be a poorer and less coherent book if he had not also attempted to offer a unifying view of his own in terms of his (new, updated, comprehensive) "accumulator model" for decision processes. Earlier versions of this model have been useful guides to data analysis and interesting sources of ideas for experiments. It is instructive to follow Vickers in his attempts to stretch the new comprehensive model beyond the statistical sampling of evidence and confidence levels for decisions, beyond even discriminations between two or more stimuli, choice reaction times and signal detection, to cover adaptation levels. With less success he interprets some issues in prolonged vigilance and inspection (pp. 230–233), as well as an extremely difficult range of problems in perceptual organization (pp. 291–341), finally covering "Choice, Control and Consciousness" (pp. 359–370).

Of course the model clearly fails to cope with the massive tasks which Vickers sets it. Success is not possible in the current state of the art and Vickers is to be congratulated for subjecting his model to the widest possible range of tests — including those that it is bound to fail. There is no better way to proceed since it is precisely the points at which a model fails that are of compelling interest for further work. We can know more clearly what the problems are only when we realize what we still need to know before we can begin to solve them.

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Nonlinear optics in gases

Peter Knight

Nonlinear Optics of Free Atoms and Molecules. By D.C. Hanna, M.A. Yuratich and D. Cotter. Pp.351. (Springer: Heidelberg and New York, 1979.) DM 79, $44.30.

THE nonlinear optical response of matter to intense radiation has been a major research field since the advent of the laser. An early spectacular demonstration of such a response was the frequency doubling of ruby laser light in a quartz crystal. Nonlinear optical processes in solids suffer from low efficiencies and damage problems. The pioneering observations of nonlinear optical processes in atomic and molecular gases by New and Ward freed the experimentalist from damage problems, and the field was further advanced by the proposal by Miles and Harris that a large enhancement in efficiency is possible when atomic or molecular resonances are exploited. Tunable frequency converters based upon nonlinear optical properties of gases are now available throughout the spectrum from the X-UV to the far infrared, using harmonic generation, stimulated electronic Raman and hyper-Raman scattering and related techniques. The authors of this book are well known for their extensive theoretical and experimental studies of nonlinear optics.

The emphasis in this much-needed book is upon the use of near-resonant nonlinear optical techniques to produce tunable radiation by frequency conversion. The first two chapters contain a careful discussion of the theory of nonlinear susceptibilities and radiation propagation. This is followed by chapters on harmonic generation, stimulated electronic Raman scattering and hyper-Raman scattering, four-wave mixing, the nonlinear optical properties of molecules, and a final chapter on new and potentially useful developments (e.g. radiative collisions and phase conjugation). Theoretical developments are carefully integrated with experimental results, with valuable statements of what remains to be understood. Practical considerations (such as heat-pipe design) are discussed at length, as are theoretical complications of selection rules and angular momentum algebra. I particularly liked the careful attention paid by the authors to units and definitions.

There are a few things I didn't care for in this book. The idea of dressed, or 'adiabatic' atom-plus-field states is presented but is applied quite incorrectly in their discussion of optical resonant saturation. If dressed states are used to describe strong-field resonant excitation, it is quite wrong to state that such a saturating field stimulates transitions between *dressed* states as the authors do in Fig. 2.4 and elsewhere. I found their discussion of such concepts confused and misleading. It would also have added to the value of the book if an elementary derivation of the susceptibility formulae had been given from perturbation theory rather than relying on a reference to Butcher's standard but virtually unobtainable monograph.

This book is valuable despite its minor faults. I am sure it will become a standard handbook for physicists and chemists interested in the generation of tunable radiation by exploiting the nonlinear optical properties of atomic and molecular gases. □

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Russian pioneer in electricity and magnetism

I.B. Cohen

F.U.T. Aepinus: Essay on the Theory of Electricity and Magnetism. Translation by P. J. Connor. Introductory monograph and notes by R. W. Home. Pp.514. (Princeton University Press: Princeton, New Jersey, 1979.) £20.70.

FRANZ Ulrich Theodor Aepinus was an outstanding physicist of the eighteenth century. His *Tentamen Theoriae Electricitatis et Magnetismi,* published in St Petersburg in 1759, was a pioneering effort to introduce mathematical analysis into these two branches of physics. Despite its importance as an intellectual landmark, however, Aepinus's *Tentamen* was never widely read. The edition was small (650 copies); published in Russia, copies were not too easily obtained in European capitals. Furthermore, the book was not reprinted or translated until a Russian edition appeared in 1951, under the editorship of Ya. G. Dorfman. Most scientists who heard of Aepinus's work encountered it by way of a secondary source, the most important of which was the epitome of Aepinus's essay published in French in Paris in 1787 by the Abbé René-Just Haüy, the great pioneer crystallographer. The mathematician Gaspard Monge, founder of projective geometry, had earlier made a summary of the *Tentamen* for his own use. In 1801, Haüy's epitome appeared in a German translation. The first major account of Aepinus's work to be published in English was in the two-volume supplement to the third edition of the *Encyclopaedia Britannica,* where John Robinson included lengthy summaries of Aepinus's theories in his articles on electricity and on magnetism. These were given wider circulation when they were later reprinted in their entirety in Vol. 4 of Robinson's *System of Mechanical Philosophy.* Thomas Young included these theories in his *Course of Lectures on Natural Philosophy and the Mechanical Arts.*

Aepinus's theory of electricity was a development from Benjamin Franklin's theory in which "the American's incompletely worked out ideas were for the first time rendered precise and fully consistent with each other". Aepinus's first contribution to electricity was his discovery in 1756 that the reason a warmed tourmalin crystal attracts dust or ashes is electrical: he soon showed that this was different from the normal electrification obtained by friction, since no rubbing is required. Additionally, the warmed crystal did not simply acquire an overall charge, but rather gained "opposite electrical charges on two opposite faces". This