

This article was downloaded by:

On: 21 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



International Reviews in Physical Chemistry

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713724383>

Book Review

L. Galatry^a

^a Faculté des Sciences et des Techniques, Université de Besançon,

To cite this Article Galatry, L.(1986) 'Book Review', International Reviews in Physical Chemistry, 5: 2, 315

To link to this Article: DOI: 10.1080/01442358609353397

URL: <http://dx.doi.org/10.1080/01442358609353397>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Book review

Molecular Quantum Electrodynamics. An Introduction to Radiation-Molecule Interactions.

By D. P. CRAIG and T. THIRUNAMACHANDRAN. (London: Academic Press, 1984.) [Pp. 324.]
£35.50. ISBN 0 12195 080 8.

Quantum electrodynamics describes the evolution of physical systems including both particles and light. It is presently the most powerful theoretical tool to understand the numerous possible events suggested by experiments and involving these two partners. The field has already been reviewed, at earlier stages of its development, in celebrated books as those by Heitler (1952), Power (1964), and others. Nevertheless the recent experimental advances in quantum optics and molecular spectroscopy necessitated and justified a new and detailed description of the theory. This is now achieved with this book by D. P. Craig and T. Thirunamachandran who, through their own researches on intermolecular forces and on optical activity, significantly contributed to several recent successes of the theory.

The book is structured following a clear pattern. In an introductory part (chapters 1 to 3), the foundations of the quantum theory of radiation and of its interactions with non-relativistic particles is presented. Besides the standard formulation going from the microscopic field equations to a discussion of the hamiltonian forms for the particle-field system in the electric dipolar approximation, these chapters contain useful presentations of more recent aspects such as, for instance, a very clear account on the statistical properties of radiation. These backgrounds are completed, at the end of the book, by a special chapter on the canonical transformations of a hamiltonian including contributions from electric and magnetic molecular multipole moments of all orders. The remainder of the book (chapters 4 to 9 and 11) presents individual accounts on the theory of elementary processes involving increasing complexity. Thus one-photon, two-photon, then non-linear optical processes and self-interactions are successively studied. The theory of the interaction between molecules and the theory of optical activity are especially developed. Moreover, recent and appealing problems such as the radiation-induced chiral discriminations or the modification of intermolecular interactions by the radiation field and induced circular dichroism are presented and discussed.

This treatise recommends itself by several characteristics. As in Power's book, extensive use is made of time-ordered*graphs which bring precious help to visualize the virtual processes occurring in a given interaction event. On the other hand, special attention is paid, for each of these events, to questions which naturally arise in the reader's mind, such as the result of a possible averaging over the molecular orientations, as well as the influence of the statistical state of the radiation. At last the equivalence of the two possible hamiltonian versions (minimal coupling formalism involving the kinetic moment of the particles versus the multipolar formalism involving their electric and magnetic multipole moments) is pointed out, when necessary, to clarify fully the theory of the processes. A selected bibliography is proposed at the end of the chapters allowing the reader to reach efficiently the most important sources.

Many interesting details should be mentioned besides the above general features. One may note a constant effort to facilitate the presentation of the (sometimes very complex) calculations. The underlying physical counterparts are nevertheless always made apparent in an illuminating way. Special sections as well as pertinent appendices fully elucidate some useful mathematical techniques such as the introduction of transverse and longitudinal dyadics or various summations over the field characteristics.

The usefulness of the book is obvious. Considered alone, the chapters 1 to 3 provide a highly valuable introduction to the science of radiation and of its interaction with particles. The pedagogical art displayed in these pages is a model of constructive and illuminating conciseness. This part of the book may be warmly recommended to advanced students. On the other hand, the entire work constitutes now, without any doubt, the reference book on this field at the research level. Its complete and beautiful elucidation of the present state of this part of the physics should be successfully used by theoreticians, but also by experimentalists to acquire the necessary fundamental background in the field of non-linear spectroscopy, optical activity and intermolecular forces.

L. GALATRY

*Faculté des Sciences et des Techniques
Université de Besançon*