operation, conversion of capacitor energy into x-ray and neutron pulses, conversion into heat as for welding and induction hardening, exploding wire and plasma pulse generation, conversion into pulsed magnetic fields for various purposes such as plasma studies, the magnetoöptical shutter and metal forming and conversion into acoustic impulses, both in air and under water.

A final chapter discusses metal working by spark erosion, explosion shock waves and electroerosion machining. A bibliography of forty-two pages, author and subject indexes and a manufacturer's index complete the volume.

A combination of detail and specialization gives the book maximum utility as a compendium of information for people interested in the field of pulse technology; its value here probably exceeds its possible textbook value due to just these characteristics. I recommend it highly to those interested in a great deal of information about red-banded woods warblers.

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Radiation transfer

SOME ASPECTS OF NON-EQUILIBRIUM THERMODYNAMICS IN THE PRESENCE OF A RADIATION FIELD. By Richard N. Thomas. 210 pp. Univ. of Colorado Press, Boulder, 1965. $5.00.

by B. E. Freeman

This book contains the updated and edited lectures presented by the author in 1961 at the Institute of Astrophysics of the University of Paris on the effect of deviations from local thermodynamic equilibrium (LTE) on the spectra and especially on the line profiles emerging from extended gaseous ensembles. Throughout the lectures the author is particularly concerned with the interrelation between the non-LTE distribution of occupation numbers and the non local character of the problem. In low-density gases, transitions between low-lying bound states are predominantly radiative rather than induced by collisions with free electrons. Consequently, bound-state populations are strongly influenced by the radiation intensity in the spectral region of the lines. In optically thick gas systems, this radiation intensity arises from emission in a volume having a radius of approximately one mean free path surrounding the point in question. The state of the gas and the profiles of radiated lines are thus determined by the solution throughout the atmosphere of the coupled equations of transfer of radiation and rate of change of occupation numbers. Hence, the solution depends not only on properties at one locality but on a self-consistent nonlocal solution.

The lectures mark the maturing of the non-LTE point of view among those astrophysicists (among whom Thomas performed pioneering studies) who maintain that an examination of all microscopic processes determining the occupation numbers of the state of the gas is required in most radiative-transfer problems. In fact, a notable advance in understanding the solar atmosphere has been achieved using the non-LTE approach in that many of the observed features of line profiles have been qualitatively explained. Of equal importance is the insight developed into the structure of the equations, which provides a guide to the selection of dominant terms among the overwhelming number of possible transitions. Thomas illustrates this approach by applying it to several models of the solar chromosphere to obtain representative line profiles and he emphasizes its use in the inverse problem, central to stellar spectroscopy, of interpreting stellar spectra to infer the parameters specifying the state of the atmosphere. The techniques, however, are basic for the analysis of laboratory plasmas as well. Consequently, as Thomas suggests, this book holds interest not only for astrophysicists but for a much wider audience.

The nonequilibrium approach to the calculation of the self-radiation from the gas is developed in seven chapters of the book, which correspond to individual lectures of the series. The first two lectures relate the intensity of radiation emitted from the gas to the optical depth and the source function in the gas. In the third lecture, occupation numbers and line-profile coefficients are related to the optical depth and source function through the equations for the rate of change of state population. The fourth and fifth lectures treat the solution of the coupled equations for the states of gas and radiation. Following a demonstration that a small perturbation calculation based on the LTE configuration as an unperturbed state is inadequate, the equations for the two-level atom are solved to display line profiles of several atmospheric models. The last two lectures indicate how the more general problem containing the continuum and additional levels may be approached. The classes into which the resulting spectral lines fall are categorized according to the processes dominating the sources and sinks of excitation of the upper level of the transition. This morphology, termed "The New Spectroscopy", holds the promise, as yet incompletely realized, of extracting from stellar spectra all of their clues about the atmospheres of stars.

As shown by recent conferences on radiation transfer, problems in radiation transfer hold interest for a large number of workers in such fields as astrophysics, oceanography, plasma physics and space physics. Now that the fundamentals of the subject are understood, this burgeoning interest would be well served by a book in which the subject is systematically developed, criteria for approximations are presented, techniques are outlined, and sample solutions are examined. Thomas has not attempted so comprehensive a program. He has, however, given a survey of the subject, with particular attention to the structure of the equations. Such an evaluation, based on many years of pioneering and participation in the field, is very valuable.

Concisely categorized references to the literature and a reasonable price add to the attractiveness of the book. Unfortunately, the style and organization of the book do not serve the purpose well. Perhaps due to the deficiencies of committing the give and take of lectures to print, this book makes for hard going. The terminology is occasionally pompous and obscure; lengthy qualitative arguments are belabored; and not a single graph to visualize the solutions is used!

In spite of these shortcomings, this book will amply reward the scientist seriously interested in radiation transfer with new insight into his field.

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The reviewer is a member of the General Atomic Special Nuclear Effects Laboratory where he has engaged in radiation-hydrodynamic investigations.

A high-level introduction

FOUNDATIONS OF THE NON-LINEAR MECHANICS OF CONTINUA. By L. I. Sedov. Transl. from Russian by Rebecca Schoenfeld-Reiner. 252 pp. Pergamon, New York, 1966. $2.50.

by Jacques E. Romain

The nonlinear mechanics of continuous media (in which the deformations of the material elements are not assumed to be infinitesimal) has been a subject of investigation for many years, but its systematic development is fairly recent. The year 1962 was an important one in this field, as it was the date of publication of the first two (to the reviewer's knowledge) general treatises on that particular subject: the book under review (first edition in Russian) and A. C. Eringen's *Nonlinear Theory of Continuous Media*. The two books come into comparison from several points of view. Each arose from a course of lectures by its author (L. I. Sedov is a professor at the Moscow State University); their coverage is broadly similar, but the emphasis is definitely different. Whereas Eringen's book is more formal in exposition, involves a more advanced mathematical background and goes into more detail in particular applications, Sedov's starts essentially from physical principles and develops general concepts and models rather than specific applications. This does not imply that the treatment is elementary. Quite the contrary, the exposition is based on general tensor formalism in arbitrary coördniate systems. To this purpose, the first two chapters are devoted to a thorough exposition of the theory of tensors (with a systematic recourse to base vectors), including a detailed presentation of nonlinear tensor functions in three dimensions. The rest