
REVIEWS

Physics of Quantum Electronics (Vol. 5)—*Novel Sources of Coherent Radiation.* Editors: Stephen F. Jacobs, Murray Sargent III, and Marlan O. Scully. (Addison-Wesley Pub. Co., Inc., Advanced Book Program, Reading, Massachusetts 01867, USA), 1978. Pp. ix + 401. Price : \$ 27.50.

This is a fifth volume on the lecture series on Physics of Quantum Electronics. The present volume is essentially devoted to free electron lasers (FEL). The first chapter traces the early history of FEL by Jaynes. In this chapter, through theoretical analysis, the validity of the Schwartz-Hora effect has been reviewed. The author thinks that it would be a considerable embarrassment to quantum theorist if this effect is found to be non-existent.

Nonlinear theory of free electron laser is given in Chapter II by Fredric *et al.* This theory is essentially classical in nature and is based on the Boltzmann equation and Maxwells equations. In addition, it is perturbative in nature. Gain formulas have been obtained in the context of FEL of the Stanford type. This theory resembles single-electron description of FEL given by Colson in Chapter IV where again, for calculating saturation levels, perturbation theory is considered to be satisfactory for the Stanford laser. The free electron laser as a travelling wave amplifier is the subject-matter of Chapter III by Kroll. The theory speaks of independent analogies with stimulated Brehmsstrahlung and Compton effect at one stage and comparison with two stream instability and non-linear Landau Damping in plasma physics on the other.

The fifth chapter by Gover and Yariv is on collective and single Electron Interactions and Cerenkov-Smith-Purcell Free Electron Lasers. The treatment is quantum mechanical from which classical results have been obtained through appropriate approximations. The periodic magnetic field necessary for a Free Electron Laser is given the analogy of periodicity in the crystal. Difference between Smith-Purcell radiation, travelling wave amplifiers, magnetic Bremsstrahlung free electron lasers and Cerenkov-Smith Purcell Lasers are described in terms of Feynman diagrams.

Chapter VII by Granatstein dwells on Electron Cyclotron Major, Beam-wave scattering Mechanisms from the utilitarian point of view. Chapter VI by Sprangle deals with the interaction of relativistic electron beam with a pump field resulting in radiation backscatter in the submillimeter and infrared range. Devices based on this phenomenon have ready applications

in Plasma heating, diagnostics, isotope separation and laser pellet fusion. The stimulated emission of radiation by electron beams while propagating through a variety of dielectric resonators via Cerenkov effect is contained in Chapter IX by Walsh. Substantial power in the millimeter wavelength has been found possible.

Chapter VIII by Schneider and Spitzer is unique in that it makes use of the stimulated Cerenkov radiation of Chapter IX and stimulated backscatter of Chapter VI to generate what is known as Stimulated Electromagnetic Shock Radiation (SESR). Devices based on this will be capable of producing powerful tunable narrow band Electromagnetic radiation; but no experimental result is yet available. In the final Chapter X, Das Gupta reports observation of X-ray lines $K\alpha_1$ $K\alpha_2$ when electron beam interacts with copper crystals.

Throughout this book, the spirit of first principle presentation claimed by the Editors in the preface has been strictly enforced.

Here is an opportunity for Plasma Physicists to contribute their mite to coherent light generation through exposure by this book.

S. KRISHAN.

Techniques of Frost Prediction and Methods of Frost and Cold Protection. By A. Bagdonas, J. C. Georg and J. F. Gerber. Technical Note No. 157. (World Meteorological Organization Geneva), 1978. Pp. 160, 17 tables, 40 figures. Price not given.

The importance of frost as an environmental factor affecting crop growth, even in tropical regions, is well known. It can cause partial or total destruction of crops, as well as retardation or termination of crop formation. Much damage to crops by frost and freezing temperature can be avoided by timely and accurate advice and warning and by use of either passive or active methods of protection. Part I of the Technical Note reviews the techniques used for frost prediction and Part II on methods of cold and frost protection.

Part I by J. C. Georg describes and assesses the empirical, theoretical, semi-theoretical and ordinary subjective techniques of predicting minimum temperature and/or frost occurrence, used in various countries. Most methods are designed for short term (less than 24 hours) forecasts of the local minimum temperature and not frost forecasting *per se*, as plants may be killed or injured without the occurrence of frost. Light or calm winds, low humidity, dry soil and clear skies

favour nocturnal cooling of the earth's surface and the air immediately above it and frost or no-frost prediction is simply dependent on the synoptic fore-caster's subjective evaluation of these factors. The physical meteorologist uses more objective techniques using well-known cooling formulae, but most techniques still involve regression-type formulae of which the hygrometric type seems most popular. The author concludes that the state-of-the-art is not developed enough to meet the present or future demands and improvement may not occur until empirical and subjective approaches are replaced by a method combining theory and statistical climatology.

In Part II, methods for frost protection used in the USA, Europe and Asia are discussed. It is unfortunate that India finds no mention except for a solitary reference among the 837 others, in spite of the great importance of protecting fruit and tender horticultural crops subject to cold weather damage and to frost in North India in winter and elsewhere at high altitudes.

Several methods of protecting plants from cold and frost depend on effective use of natural heat sources to provide favourable changes in the heat fluxes from the soil and the air. Active methods usually modify the nocturnal microclimate directly either by burning fuels and freezing water or by increasing the turbulence to change the heat balance with the use of wind machines, helicopters and other devices. Overhead sprinkler irrigation has been successfully used for the prevention of low-growing crops and deciduous fruit trees. Passive protection involves the use of moist, compact cultivated soil to produce a favourable heat balance, earthen mould or insulating wraps, around trees to cover bud unions, trenches and covers to protect individual plants, paints to increase the hardness of plants and so on. Indirect methods which are biological and ecological in nature are mainly preventive. The detailed description of the various methods used in different countries and the authors' conclusions on the advisability of using different methods add to the value of the book. But 538 extensive references for Part II are given in Russian, which will be difficult for most readers to follow.

A MANI.

Physics and Chemistry of the Earth—An International Review Journal (Vol. 10, No. 4, 1977); Editors: L. H. Ahrens, and S. K. Runcorn. (Pergamon Press Ltd., Headington Hill Hall, Oxford OX3 0BW, England). Pp. 215-260. Price \$10.00 or £5.50.

The particular number of the journal referred for reviewing has two main articles on the Chemistry of the Moon. One on the mineralogy, petrology and chemistry of the ANT-suite rocks from the Lunar

High-lands by M. Prinz and K. Keil. The second article is on the petrology, mineralogy and chemistry of KREEP basalt by C. Meyer, Jr.

The first article discusses the terminology and classification problems of Lunar High-land rocks; mineralogy, petrology, major element composition and genesis of the cumulate ANT-suite. The second article also discusses the problem of nomenclature, mineralogical characteristics of individual samples, crystallisation sequence, chemical and isotopic characteristics of KREEP basalt, genesis of KREEP basalt magma and the secondary processes which have operated on them. The two papers have made a significant contributions to our knowledge of mineralogy, petrology and chemistry of the important Lunar rocks. Regarding the origin of ANT-suite rocks, the author feels that from a parental liquid of high-alumina basalt melt with low Fe/Fe + Mg (~ 0.1), spinel troctolites, troctolites and dunites are formed as early cumulates, and norites and anorthositic rocks as later cumulates. This study may throw some light on the much debated origin of the terrestrial ultramafic rocks.

C. NAGANNA.

Handbook of Meteorological Forecasting for Soaring Flight. Technical Note No. 158. (WMO No. 495, World Meteorological Organization, Geneva), 1978. Pp. viii + 101. Price not given.

Soaring, or gliding as it is commonly known, is one of the most exciting of sports. The world record for straight distance soaring is 1461 km and for absolute height 14,102 m. The former is held by Hans Werner Gosse for a flight from Lubeek in Germany to Biarritz in France in 1972. Duration records are no longer attempted. The record stands at 56 hours and 15 minutes.

Launch is usually made to a height of 300 and 600 m and the pilot has to find after launch a region where the air is ascending faster than the sailplane sinks with respect to the air. This occurs usually near slopes, in thermals and in wave updraughts.

The need for special forecasts for soaring flight has increased in the last few years, with the increasing number of active soaring pilots and of the many national and international competitions held each year throughout the world. The present Handbook makes available in a single publication general forecasting rules for soaring flight. It was prepared by a Meteorological Panel of the International Scientific Soaring Organization and is published by the WMO.

Chapter 1 describes certain technical aspects of soaring flight and the various weather factors which influence soaring, conditions preventing or restricting thermal soaring and situations of particular danger to soaring flight. The weather factors which influence soaring

are surface and upper winds, visibility, cloud base and cloud amount. Forecasts normally involve forecasting thermal convection, prediction of the onset and duration of thermals, of solar heating and the development of cumulus, of sea breeze and convergence lines, cloud streets and of mountain and lee waves.

The next four chapters deal with the forecasting of thermal updraughts, most commonly used for soaring and of "wave soaring" or soaring in mountain wave or lee waves. Chapter 6 deals with the use of weather satellite data as an aid to soaring forecasts and Chapter 7 with the preparation, presentation and standardization of soaring forecasts. The final chapter presents examples of outstanding soaring flights with short discussions of their respective weather situations.

The principles outlined in this Handbook are also applicable to the sports of motor gliding, hand gliding, ballooning, parachute jumping and flying light aircraft. A list of references adds to the value of the book.

A. MANI.

The Substantial Space, and Void Nature of Elementary Material Particles. By P. Tewari (Satyasaibaba Publishers, 157, Shivaji Park Road, No. 5, Narain Sadan-1, Bombay 400 016), 1977. Pp. x+98. Price Rs 12-00.

The idea of 'Aether' is commonly believed to have died when special relativity became accepted. There are, however, still a few who regard its existence as essential for understanding physical phenomena. This book is written by one who belongs to this select band of 'aetherologists'.

The author postulates that: (i) there is a finite volume of only one substance in the universe that constitutes only the Space and not the interior of fundamental material particles; (ii) the substantial Space is continuous (structureless) and hence incompressible and massless superfluid with zero viscosity loss in motion, that can flow up to a maximum speed C cm/sec and through which transmission of pressure and under-pressure effects also take place at constant speed C cm/sec, where C cm/sec is the propagation velocity of light in Space; (iii) the substantial Space of the universe is in circulating motion with respect to the centre of the universe which is the only absolute point of reference, with maximum circulation at universal centre and minimum at universal periphery.

On the basis of this theory the author discusses cosmology, inertia, electric charge and other matters

of fundamental nature. The argument is highly confused with the author seemingly unaware that numerical coincidences have a possible significance only if they refer to dimensionless quantities. The mathematical discussion, although elementary, still betrays the author's apparent lack of understanding of simple notions.

Personally, I do not think that after reading this book the physicist will feel sympathetic to the idea of aether, at any rate in the form presented here.

J. V. NARLIKAR.

Botanists and Botanical Researches in Maharashtra (1951-1957). By N. D. Kamat. (Vimal Prakashan, 27/159 Anand Nagar, Aurangabad, 431 001), Pp. vi + 310, Price Rs. 50.

This book written by Dr. N. D. Kamat includes in the 1st part Bio-data of about 80 Botanists. The 2nd part lists some 2,000 research papers and the 3rd a list of some 200 Ph.D. and D.Sc. theses submitted to the Universities in Maharashtra. The Appendix is also given subject-wise.

As can be seen, the author has done a good job in compilation of work of this nature which is time-consuming. Review of literature is spread over a period of 25 years (1951-1975). However, neither the list of papers nor the authors of such articles during this period is complete. There have been many omissions and I wish the author had taken a complete list of all the workers and so also their papers. For example, on page 87 there are two papers listed by Drs. Govindu and Thirumalachar. The same authors have published several other papers which do not find a place. Similarly, there are several such omissions. However, this does not mean that this book does not deserve a place that it ought to receive in a publication of this nature. There are very few books of this nature where authors and their publications are listed. In this respect, this publication deserves commendation. It is hoped that the author would make it up-to-date while publishing the revised/second edition. The author should be complimented for listing out workers interested in Botany in Maharashtra and also their publications. This gives a comprehensive picture especially to the younger generation interested in the field of Botany and allied branches.

As regards the price, Rs. 50 is perhaps abnormal for a book of this nature. If the price is brought down to Rs. 10-15, more people would be able to purchase the same.

H. C. GOVINDU.