

**OPTICAL THEORIES BASED
ON LECTURES
DELIVERED BEFORE THE
CALCUTTA UNIVERSITY**

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Optical theories based on lectures delivered before the Calcutta University by D. N. Mallik

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BASED ON LECTURES DELIVERED BEFORE
THE CALCUTTA UNIVERSITY

BY

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PREFACE

IN the year 1912, the University of Calcutta appointed me Reader in Physics and invited me to deliver a course of lectures to its advanced students on Optical Theories, one of the conditions of the appointment being that the lectures should be published after their delivery. The lectures were actually delivered during the months of February and March, 1912, but pressure of other work has prevented me, till now, from seeing them through the press.

It has been my object in these lectures to trace the development of Optical Theories from the earliest times to the present day. I have tried to understand and help others (so far as I can) to understand the relation between the different theories, so that one may be clear as to how much is certainly known and how much is mere speculation. In the midst of the bewildering mass of investigations that a student of luminiferous medium is confronted with at the present day, a sketch, such as the one attempted here, describing, with such details as will make the general argument intelligible, how we have been led up to the present position and what that position really is should, as it seems to me, be of considerable use. How far I have succeeded in my attempt, it is for others to judge.

To the latest developments of the optical theory including the theory of relativity, no reference has been made here. I hope to deal with them in a later volume, if the present attempt proves successful.

D. N. M.

November, 1916.

PREFACE TO THE SECOND EDITION

IN the present edition, I have included a brief account of the theory of relativity and the quantum theory which had been previously left out for a separate and special treatment. It has since appeared to me, however, that no statement of the present position can be regarded as at all satisfactory at the present day, which omits a reference to them altogether.

The subject matter of the present treatise—the nature of the electro-magnetic field—is, in reality, the one great general problem of modern Physics. For “if,” to quote Larmor, “it is correct to say with Maxwell that all radiation is an electrodynamic phenomenon, it is equally correct to say with him that electrodynamic relations between material bodies are established by the operation, on the molecules of those bodies, of fields of force, which are propagated in free space, as radiation and in accordance with the laws of radiation from one body to another.” And it seemed to be desirable that the points of view which the new theories represent, should be stated, however briefly, in order that the nature of this problem and the attempted solutions may be clearly brought into view.

D. N. MALLIK.

March, 1920.

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CHAPTER I

INTRODUCTION. CORPUSCULAR THEORY. UNDULATORY THEORY

SECTION I. ANCIENT SPECULATIONS. DESCARTES. FERMAT

1. A complete theory of optics has to furnish an adequate account, not merely of the nature of light but also of the mode and mechanism of its propagation, as well as the nature of the medium in which the propagation takes place. And we shall see, as we pass in review, in historical order, the various theories that have been proposed, that our knowledge on these points is after all extremely limited.

2. This, indeed, is what is to be expected—illustrating, we may remark in passing, the limit and scope of scientific inquiry in general. For, although the phenomena with which, to confine ourselves to optical investigations alone, we have to deal are simple and well-known, and although we can formulate the laws governing them—like any other body of scientific laws—which state (as Karl Pearson has put it), “in conceptual shorthand, that routine of our perceptions, which forms for us the totality of the phenomena,” to which they refer, when we come to inquire into the intimate nature of the processes, associated with these laws, we are confronted with insuperable difficulties. These are so subtle and deep-seated, that they will probably always elude our grasp. We are, therefore, reduced to preparing models, that shall approximate to the actual, as far as possible, and our task consists really in improving these models, more and more, so that they may more and more nearly approximate to the actual. Thus, of the mode of propagation of light and the nature of the medium which takes part in its propagation, we, with our limitations, can never have any direct knowledge.