long analysis is required to justify the approximation that the bending couple is proportional to the curvature. In the cases of plates and shells the necessary analysis is still more lengthy. The problem is complicated by the fact that the bending is usually accompanied by stretching particularly near the edges. The book concludes with an account of the important practical problem of the stability of cylindrical shells. It is perhaps needless to say that the treatise can be heartily commended both as a text-book and a book of reference. A German edition was published by Teubner in 1907.

F. R. SHARPE.

Les Découvertes modernes en Physique. Par O. MANVILLE. 2ème édition. Paris, A. Hermann et Fils, 1909. 463 pp.

ONLY a year after the first edition of Manville's short book of 182 pages on Les découvertes modernes en physique a second edition was needed. The author evidently did not have to contend with costly electrotype plates in which the publisher would allow few changes, for he has practically written a new book about three times the size of the first — the term second edition is really a misnomer. The new work is divided into two parts, entitled Electricité et matière and Les ions et les électrons dans la théorie des phénomènes physiques — La matière et l'éther. This entire rewriting and expansion of the original is very fortunate. The state of fundamental electrical theory is to a considerable extent still speculative, and experiments which reveal new and sometimes nearly crucial results are still of frequent occurrence. To write at all on this subject brings with it the liability and desirability of rewriting after the lapse of a very short period.

From the title of the work we might be inclined to fear that the author had written a popular and unreliable essay on the wonders of recent discoveries. Fortunately this is by no means the case; many chapters contain considerable hard physics and more or less hard mathematics, which require and repay close application on the part of the reader. The presentation, however, let it be stated, deals with a vast variety of interrelated physical data after the manner of the experimental physicists rather than with the broad mathematical groundwork of electrical theories as treated by such theorists as Larmor, Lorentz, or Minkowski. Sooner or later, theory and experiment in regard to atomic electricity will probably be well knit together;

at present the data are too diverse and too numerous to be worked into any mathematical theory, and the different theories are in need of crucial experiments. In addition to these general observations only a few words as to the contents of the work under review need be added.

The author begins with the discussion of the conduction of electricity by liquids and of the ionic theory of electrolysis. He then takes up the corresponding questions for gases; this, of course, requires a much longer treatment, as it involves cathode rays, X-rays, Lénard rays, and electrons. Then follows the electronic theory of matter with a detailed discussion of radioactivity. This ends the first part of the work and is to all intents and purposes merely a new edition of the original volume. In the second part the author goes over the data above presented and applies the facts and points of view acquired to the connected study of the phenomena involved — first, as regards liquids, second, as regards gases, whether ionized or not, and third, as regards solids. The volume finally closes with a discussion of matter and ether.

To write the second part must have been a much harder task than to write the first; for whereas the fundamental facts as to atomic electricity are tolerably firmly established and generally agreed to, the manner in which those facts shall be interpreted and combined into physical theories is by no means so well settled. For instance in the treatment of electric and thermic conductibility in metals there is the theory of J. J. Thomson and the English school of physicists, that of Drude and the German school, and that of Lorentz. None of these theories is as yet entirely satisfactory; the author carefully presents them all and makes a few comments as to their several defects or excellencies. It will thus be seen that we are in possession of a work which will serve probably better than any other one book to orient the student in regard to the modern physics of electricity and to place him in a position to read critically the original memoirs that have appeared or may appear — in short, to put him quickly and easily where he can and must do some real thinking for himself.

E. B. Wilson.