firmed dyspeptic, he will be spent in her service. But the memory of these services will survive, and the little book to which we direct attention will serve to perpetuate it.

T. E. THORPE.

GRAVITATION AND RELATIVITY.

The Physical Society of London. Report on the Relativity Theory of Gravitation. By Prof. A. S. Eddington. Pp. vii+91. (London: Fleetway Press, Ltd., 1918.) Price 6s. net.

IN the year 1905 a paper was published by Dr. A. Einstein which gave to the world of physical science a new subject for controversy under the title of "The Principle of Relativity." For ten years discussion reigned between those who held to the æther as a firm basis to the universe, and those who, treading more mathematically, felt a safer foothold on Einstein's elegant abstraction, little caring that æther, space, and time all trembled.

While men talked, the author of the disturbance was quietly preparing a greater. His first effort had left to the materialist a little comfort and cause for self-conceit in that it had not succeeded in resolving the old contradiction between a metaphysical theory of the relativity of space and time and the apparent existence of an absolute standard of rotational motion. The new theory, however, claims, not only that the complete relativity of space and time is true to the facts, but also that it can throw light on gravitational phenomena which was not shed by the more limited principle. To quote the author of this report: "*Einstein's theory has been successful in explaining the celebrated astronomical discordance of the motion of the perihelion of Mercury without introducing any arbitrary constant; there is no trace of forced agreement about this prediction.*"

Any theory of gravitation which succeeded in doing this would be worthy of serious consideration, but what words should be applied to one which transcends the limitations of Newton's marvellous achievement through the acceptance of the doctrine of complete relativity of space and time?

In the earlier theory the one essential constant and invariant magnitude was the velocity of light (c). In mathematical signs, $dx^2+dy^2+dz^2-c^2dt^2$ was invariant. It is obvious that this cannot be so for a complete relativity, but a general quadratic expression in dx, dy, dz, dt will remain through all changes an expression of the same type, though the coefficients of the several terms will be functions of position and time instead of constants. In the new theory it is assumed that the physical properties of space are such that there is a quadratic form of this kind which remains invariant. The physical state at any point and instant is summarised in the values of the coefficients. It is Einstein's achievement to have been able to apply the work of the pure mathematician to find equations between these quantities which, while reducing to the equations of Newtonian gravitation for all frames of reference to which the old principle of relativity applies, have a completely invariant form.

While we wonder at the feat, and at the vision of a hitherto uncomprehended unity of thought, there remain some obstinate questionings. If this dream of complete relativity be true we are getting near the point at which it is so general as to lose touch with common experience. The new law of gravitation has not that astounding simplicity of expression which distinguishes that of Newton. The old problem of absolute rotation is thrown further back; but it remains true that there are systems of reference for which dynamical phenomena present their greatest simplicity. We ask why our first naive choice of a system of measurement ready to hand is such that within it material bodies have a nearly permanent configuration, and light has an approximately constant velocity.

Generalisation is the supreme intellectual achievement, but it may leave us thirsting for the particular and for simplicity. This report on what may be the most remarkable publication during the war leaves us wondering in which direction the greater satisfaction is given.

OUR BOOKSHELF.

Mnemonic Notation for Engineering Formulae. Report of the Science Committee of the Concrete Institute. With explanatory notes by E. F. Etchells. Pp. 116. (London: E. and F. N. Spon, Ltd., 1918.) Price 6s. net.

THIS book contains a series of miscellaneous papers dealing with the application of mnemonic notation to various branches of pure and applied science, and especially to structural engineering. The formulæ of science should not be expressed in misleading symbols which are not suggestive of the quantities concerned, but in a notation which is the "embodiment of organised common sense." The key to the notation adopted is to be found in the abbreviation of the significant words in any term until only the initial letter remains. In a few instances the second, or even the final, letter may be retained to form a subscript to the initial letter. "The *greater* letters are used to indicate *greaterness* of quantity or *greaterness* of complexity."

There is no doubt that the scheme proposed is founded on sound principles, which have been long recognised by competent teachers. To some it may seem that in parts of the present volume there is a tendency to elaborate the obvious, and that the report would have been more convincing if there had been fewer repetitions and less frequent use of odd and unfamiliar language. A series of useful appendices dealing with various practical questions, such as calculations for business purposes and the printing of mathematical formulæ, occupies more than two-thirds of the book.