ON THE INTERIOR CONDITION OF THE TERRESTRIAL GLOBE.

By M. E. Roche.

Generally we admit that the earth is entirely fluid in its interior, with the exception of a thin crust, and most of the mathematical studies on the figure and the constitution of the earth assume this fluidity. Thus by attributing to this fluid a certain law of compression, Laplace has deduced a corresponding law of densities, which Legendre had already examined before him, and which permits the calculation of the flattening of the different surfaces *de niveau* of the terrestrial mass. I have myself proposed another law of compressibility, which conducts to a very simple formula for the increment of the density. The conditions which every hypothesis must satisfy, on the distribution of the mass in the interior of the earth, are that it must accord with the value of the superficial flattening, and also with a certain constant depending on the phenomenon of precession. These conditions are very approximately satisfied in the hypothesis of fluidity, if we admit that the terrestrial flattening is nearly $\frac{1}{300}$; but if this flattening is greater than $\frac{1}{295}$, as it seems to result from the most recent determinations, the agreement no longer exists.

There is need, therefore, of a new examination of these researches under a different hypothesis, for example, in considering the globe as formed of a nucleus or solid mass very nearly homogeneous, covered with a lighter shell whose density, from geological considerations, can be estimated as 3 with respect to water. This constitution of the globe being supposed, I find that it is possible to conciliate the actual values of the precession and of the flattening, if we take account of this, that the interior nucleus of the globe solidified and has taken its definitive form under the influence of a rotation less rapid than that with which the earth is now animated.

In every case the contraction due to this cooling of the globe must lead to a progressive acceleration of its angular velocity. But if this globe is fluid the figure of the different strata adapts itself continually to the rotation which has place at each instant, in such a way that finally there remains no trace of the successive variations which their flattening have undergone since the origin. If, on the contrary, at a certain epoch of the cooling the interior strata have passed to a solid state, these strata have taken and preserved a flattening very different from that which would be attributed to them by the general equation of hydrostatics applied to a mass entirely fluid and possessing a rotation common to all its parts. The formulæ calculated in the hypothesis of a solid nucleus contains at the same time the constant q, the actual ratio of the centrifugal force to the equatorial gravity, and value q_0, of the same ratio at the epoch of the solidification of the central mass. This last element, not being determined, we can give to it a value such that the superficial flattening accords with the coefficient of precession. It is necessary for this to suppose q_0 less than q, whence it results that the terrestrial rotation has undergone an acceleration since the consolidation of the interior nucleus.

The physical and astronomical conditions of the problem permit also the determination, with some precision, of the dimensions and specific weight of this central mass. If we leave out of consideration the crust purely superficial, as also a slight condensation towards the centre where the heavier materials would be collected, the constitution of the globe will be as follows: a nucleus, of which the density is nearly 7, covered with a shell of density 3, whose thickness does not attain one-sixth of the entire radius.

The central terrestrial mass is therefore in specific weight analogous to meteoric iron, while the stratum that envelops it is comparable to aerolites of a stony nature, where iron enters only in a small proportion.

BOOKS RECEIVED.

The Microscope and its relation to Medicine and Pharmacy. Edited by Chas. H. Stowell, M. D., and Louisa Reed Stowell. Published monthly. Ann Arbor, Michigan, 1881.

There are already two journals published monthly which are devoted to microscopy, it is therefore with some surprise that we find a third journal of the same description appealing to the patronage of Microscopists.

"*The Microscope*" claims to supply a want in offering physicians a journal which treats exclusively of Medical and Pharmaceutical Microscopy, thus differing from the two former microscopical journals which cover the whole field of Microscopy.

We believe that the success of "*The Microscope*" will depend upon that journal being conducted strictly within the limits of its own programme. Undoubtedly the majority of American microscopists are members of the medical profession and, therefore, "*The Microscope*" may look for a numerous constituency.

"*The Microscope*" has been produced in an excellent form, is well printed, and illustrated with good illustrations, and if the editors will confine the columns to *Microscopy*, to the exclusion of facetious "items" clipped from their exchanges, they may hope to place their journal on a firm basis.

CORRESPONDENCE.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

To the Editor of "Science."

Permit me to suggest a few questions that should be answered by the author of "The Great Primordial Force." (See "Science," p. 405.)

Let me introduce my questions by announcing my *belief* in the conservation of energy and in the unity of force and by expressing a *hope* that the time will come when the phenomena peculiar to the different *manifestations* of force may be comprehended and their identity demonstrated.

The following questions are respectfully suggested:

1. When, and by whom, has it been demonstrated that gravitation is resolvable into light or heat?

2. If all force "is substance," or matter, (see "Science," p. 405, last paragraph), then, at least some matter is force. What then is the distinction between matter and force?

3. On p. 406, it is asserted that the two elements, "*Motion* and *Magnetism*," "develop all known forces of the universe." How can motion exist without a *prior* force, and what *is* magnetism?

4. What produces the revolution of the revolving celestial armatures?

The foregoing questions may be sufficient for the present, but it is due to science that statements claiming to be scientific should be *truths*. Let us examine some of the author's statements.

It is asserted that "if gravity acts inversely as the square of the distance, then the earth at aphelion could not, without the aid of some other force, return to perihelion." It is to be feared that the author of the above question is not aware that the inertia of matter is an experimental fact, and is entirely sufficient to bring back the planet from aphelion to perihelion.

As to the law of inertia, all matter, if not acted upon by some external force, will continue in its present state, whether of motion or rest, and because while a planet is passing from perihelion to aphelion the tangent to its orbit makes an obtuse angle with its radius vector; therefore its inertia counteracts, and to a certain extent,