Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Ether-Drift and Relativity.

DR. SILBERSTEIN'S deductions from Prof. D. C. Miller's surprising optical experiments, as contained in NATURE for May 23, are equivalent to stating that there is a drift of the ether with respect to the earth, and the horizontal component velocity of this drift is very small at ordinary ground level but rapidly increases with height z, so that it reaches about 10 km./sec. at the height of Mt. Wilson (1·731 km.); whence $\delta u/\delta z = 5{\cdot}7$ sec.$^{-1}$ approximately for the intermediate zone. The mere existence of this measurable drift would be in conflict with the very foundations of relativity.

Objection against these conclusions is raised in NATURE for June 6 by Prof. Eddington, who remarks that the described ether-flow being strongly rotational, it could not satisfy Stokes's condition for non-influence on astronomical aberration; and the consequences would be in disagreement with the measurements made every day in astronomical observatories.

I think that from the mathematical point of view this objection may be removed on remarking that it takes into account only the horizontal component of the drift. If x is the co-ordinate in the direction of this component, and w is the vertical component of the drift, the full expression for the *curl* of the drift-velocity in the xz plane is $\delta u/\delta z - \delta w/\delta x$, and therefore the flow might be everywhere irrotational, even with a high value of the term $\delta u/\delta z$, provided there is a corresponding $\delta w/\delta x$ to match it.

It is true that in the light of the first theory given by Stokes and expressed by Lorentz in his standard book "The Theory of Electrons," Ch. v., 147-148, the irrotationality of the flow would not be sufficient to destroy the influence on aberration, and certain additional conditions ought to be satisfied by the velocities of the ether near the stars and near the earth. But a careful consideration shows that the aberrational effects as observed by astronomers do not depend on the differences between the directions on the wave normals at the origin and the end of the light-ray, as considered in the above theory, but exclusively on the paths of the light-rays themselves. Therefore, the right theory to be employed is the second one given by Stokes with Challis's corrections, and further developed by Larmor in "Aether and Matter," iii. 22, according to which the irrotationality is the only condition required.

In the light of this conclusion, Planck-Silberstein's hypothesis of an irrotational and extremely compressible ether with a negligible drift at ground level might be sufficient to secure agreement with all standard astronomical measurements at all heights, and with terrestrial geodesic observations (absence of geodesic aberrations); but it requires a compression so high as 60,000 at sea-level; and it further requires that the "grip" of the earth on the ether be purely gravitational, according to Silberstein's vivid expression, because Michelson and Gale's experiment has shown that the ether does not follow the daily rotation of the earth. Even a broader theory might be adopted, since the latter experiment, performed inside an iron pipe, shows that the pushing forward of the ether by the earth, if any, is not due to impenetrability or to adhesion to material surface, and therefore Planck's condition that the vertical flow of the ether at ground level be zero may be discarded.

Three points of difficulty are, however, to be considered, namely:

(1) To show that an irrotational distribution of flow can be effectively mapped out, which numerically agrees with the various values of the horizontal velocity found by Prof. Miller at different heights and times.

(2) To explain why, since the grip on the ether is not due to material surface adherence, its horizontal drift is reduced so nicely to zero at about sea-level and not to any other level whatever.

(3) Since $\delta w/\delta x$ requires to be so high as 5 or 6 sec.$^{-1}$, it follows that if the vertical drift be zero at a certain point, it will be about 500 km./sec. at some point at 100 km. distance at the same level. If there is a vertical ether flow of this magnitude, it will be revealed at once by very common electromagnetic experiments or by a quite unrefined repetition of Prof. Miller's experiment in a vertical direction.

In the present condition of things it will be advisable not to draw any conclusion from Prof. Miller's experiments until results of further experiments are available, and until, finally, we are able to examine whether some unknown phenomenon has affected the results.

GIOVANNI GIORGI.
University of Rome
(Regia Scuola d' Ingegneria),
June 29.

P.S.—Since writing the above, I have seen Prof. Miller's article which appears in the issue of NATURE for July 11, giving further and very interesting particulars on his experiments. My conclusions are not modified by it. G. G.

Experimental Study of the "Soaring" of Albatrosses.

THE letter by M. Idrac, under the above title, in NATURE of April 11, was one constituting an earnestly important contribution to the fascinating subject of soaring flight; for it is undoubtedly the case, that so far as the sea considerably impedes the lower strata of the wind, an albatross must be able to soar in the manner recorded. The methods of energetics (having regard to the internal energy of the air) may certainly be employed to indicate this, but the less often used acceleration-of-headway method may be employed as a simple, precise, kinematical alternative. For example, when the bird in its relationship to the enveloping air is gliding upwards at an angle α degrees above the horizontal, at a headway of V feet per second, and against a wind from the north, it is tending to lose headway gravitationally at the rate of $g \sin \alpha$ feet per second per second. It may also be regarded as tending to lose headway frictionally, at the rate of g/n feet per second per second, where n is the ordinary lift/drag ratio. On the other hand, if the higher strata of the wind are travelling faster southwards, to the extent of v feet per second for each foot of vertical height, the bird tends to gain headway at the rate of $Vv \sin \alpha \cos \alpha$ feet per second per second, because $v \cos \alpha$ feet per second is the component of increment of wind velocity head on to the bird, per foot change of height, and $V \sin \alpha$ feet per second is the vertical rate of gain of height. Accordingly, for the bird to continue gliding upwards at steady or increasing headway it simply needs to have

$$Vv \sin \alpha \cos \alpha - g \sin \alpha - g/n < 0, \quad . \quad . \quad (1)$$

that is to say, not negative.