phorus is brought towards the lamp, the loops will diverge and strike the sides. Or if the displacement is only partial, the loops will swing back to their original place of rest directly the charged plate is removed to a distance. If, however, the metal disc of the electrophorus, positively charged, is brought towards the still lighted lamp, there is no movement of the loops. Equilibrium of potential is attained by emission of electrons from the filament. But as the disc with its positive charge is being moved away the loops diverge and may strike the glass.

What is most remarkable is this, that if the displacement of the loops is only partial, and not up to the glass, then when the disc is removed, the loops retain their displaced position and very slowly creep back to their original place of rest. It is this last phenomenon which clearly indicates the great difficulty of negative electricity returning to the glowing filament, or of positive ions leaving it.

The Beta rays from a few milligrams of radium near the lamp produce in it an ionisation current which accelerates the creep into a rapid motion, to the natural position of the filament.

These experiments with the electrophorus can all be carried out through a dry wooden drawing-board more than half an inch thick. When projected by a lens on a screen the motions of the filament afford interesting lecture-room illustrations of the thermionic current.

The valve action inside high vacuum lamps was explained by Fleming (Proc. Roy. Soc., 1890, vol. xlvii., p. 122). An account of his work is given in his well-known book on "Electric Wave Telegraphy" (second edition, p. 478).

So far as I know, the experiments described in this letter, with an electric force, produced outside the lamp, have not been previously published.

A. S. EVE.

McGill University, Montreal, January 29.

The Densities of the Planets.

THE prominence you give to M. F. Ollive's note in *Comptes rendus*, tome 157, No. 26, induces me to point out that M. Ollive's so-called empirical formula is really a simple statement about the densities of the planets. The formula is $r^3 = kRR'v'^2$, where r is the mean radius of any planet, R its mean distance from the Sun, R′ the mean distance of any satellite from its primary, and v' the mean orbital velocity of the satellite. v'^2R' for any satellite can be replaced by γM, where γ is the gravitation constant, and M is the mass of its primary, since we can ignore the mass of the planet as compared with its primary. We get then $r^3 = k'RM$, where k' is a new constant. But $M = \frac{4}{3}\pi\rho r^3$ where ρ is the mean density of a planet. Thus we get $R\rho$ = constant. This is what M. Ollive's formula amounts to. In other words, his formula does not derive any generality by the introduction of the satellites. The fact that his results for the various satellites of any given primary agree *inter se* is merely Kepler's third law.

The value of M. Ollive's "empirical" formula is thus to be measured by the extent to which the formula ρR = constant is true of the planets of the solar system. As it happens, this is at all approximately correct only for Earth, Mars, Jupiter, and Saturn. The densities as generally accepted are, taking the planets from Mercury outwards, 0·85, 0·89, 1·00, 0·71, 0·24, 0·13, 0·22, 0·20. The density of the earth is taken as the standard. M. Ollive's formula gives 2·58, 1·39, 1·00, 0·66, 0·19, 0·10, 0·05, 0·03. It is evident that M. Ollive's "empirical" formula is quite wrong for all but the four planets mentioned, and even for these the agreement is by no means encouraging.

It may be urged that the densities are not observed directly, but are inferred from the masses and the radii of the planets, so that a small inaccuracy in the observed radius of any planet may well account for a considerable error in the inferred density. But I very much doubt whether astronomers will be ready to admit possible errors of 50 per cent. in the radius of Uranus and 100 per cent. for Neptune. They will certainly decline to concede an error of 50 per cent. in the radius of Mercury and of 12 per cent. in the radius of Venus.

SELIG BRODETSKY.

University of Bristol, March 3.

An Optical Representation of Non-Euclidean Geometry.

LET us suppose Euclidean space to be filled with a medium of variable refractive index. Then to an observer in that medium the curved path of a ray of light will present all the appearances of a straight line, and, further, if the observer estimates the distance between two points by the time light takes to pass between them, this path will appear to be the shortest distance between the two points.

Suppose now that one or more such observers conduct an Ordnance Survey of the region occupied by the medium, using theodolites to measure angles, and imagine them to be equipped with instruments capable of measuring the time interval occupied by optical signals in transmission from one station to another, this interval being used as a measure of the distances between the stations. It is clear that these observers will obtain what to them must be a convincing proof that the sum of the three angles of a triangle cannot possibly be always equal to two right angles. And it would not be easy for an individual whose methods of observation of the geometrical properties of such a region were limited to those here assumed to believe that the space in which he lived could contain a Euclidean geometry.

G. H. BRYAN.

NATURE RESERVES.

IT is only too true that man is slowly but surely destroying the beautiful wild animals and plants of the world, and is substituting for them queer domesticated races which suit his convenience and his greed, or else is blasting whole territories with the dirt and deadly refuse of his industries, and converting well-watered forest lands into lifeless deserts by the ravages of his axe. It is not too late to rescue here and there larger and smaller areas from this awful and ceaselessly spreading devastation. In remote lands there are large tracts which may be taken in charge by the local government and rescued from destruction, and to some extent this has been done. Even in our over-crowded European states there are still lovely bits of forest, marsh-land, and down which man has not yet irretrievably befouled, and from which he has not yet driven by assault nor removed by slaughter the beautiful living things which nature has guided and nurtured in their seclusion. There is yet time! Some of these little scattered fragments of our great mother's handiwork can still be preserved even in England, Wales, Scotland, and Ireland, so that future Britons may not utterly curse us, but enjoy, with gratitude to those who saved them, the precious living relics of the world as it was before man destroyed it.

There must be many who have in these days