

From the laws of thermodynamics it can be shown, doubtless, that the conservation of weight is absolutely true, but this only on the assumption that the conservation of energy is absolutely true. Again, granted it can be shown that the conservation of weight is true in the same degree as the conservation of energy, yet these proofs will remain of strictly mathematical interest so long as our knowledge of the conservation of energy remains of a lower order of accuracy than that of the conservation of weight.

It seems natural for the human mind to state scientific laws in absolute terms. Nevertheless, in most cases it is proved that the accuracy of the laws is limited. If a scientific law is believed in outside the limits of proof, the law is no longer a matter of knowledge—it has become an article of faith. These are platitudes; they have point only because scientific men state the laws of conservation in absolute terms, and hold these laws as articles of faith.

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### A Solar Halo.

In a letter to NATURE of May 1 (p. 5) a description is given of a remarkable lunar halo seen at Yerkes Observatory. A solar halo of almost identical character is reported in the meteorological returns for April from Sule Skerry Lighthouse off the north coast of Scotland. The following note and sketch are appended by Mr. N. A. Macintosh, the lightkeeper, to his report:—

"A curious phenomenon was observed in the sky on the 28th. At 12.30 p.m. there was a perfect ring or halo right round

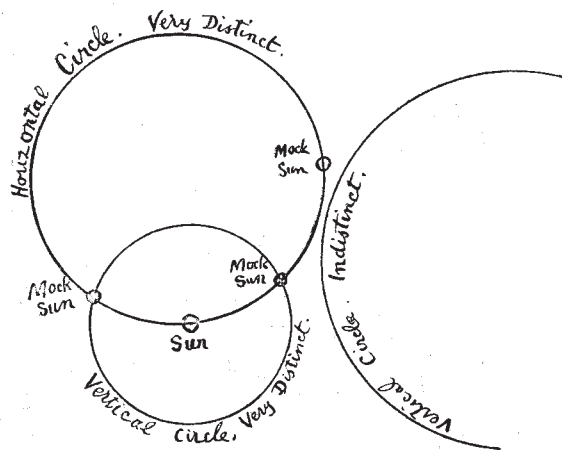


FIG. 1.—Solar Halo, April 28.

the top of the sky with the sun in its southern edge. At right angles to it, and round the sun, was another ring with two 'mock suns' where it bisected the larger ring. These 'mock suns' showed prismatic colours, but about due east on the edge of the larger ring there was a 'mock sun' pure white. In the south-eastern sky there was an indistinct half-circle from the horizon up to the horizontal circle which showed prismatic colours, whilst the others were colourless. At the time there was haze all over the sky, but the sun shone very clearly. It lasted till 1.30 p.m."

The position of Sule Skerry is lat. 59° 6' N., long. 4° 20' W., and as the sun is about 14° north of the equator on April 28, its elevation at local noon, about which time the halo was first seen, would be practically 45°. Hence the "horizontal circle" the centre of which is at the zenith would have a radius of 45°. Evidently, therefore, from Mr. Mackintosh's sketch the "vertical circle" is the ordinary halo of 22° radius. The "horizontal circle" is also well known, though not so often seen as the halo; it is due to the reflection of the sun's light from the vertical faces of the ice-crystals. The coloured mock suns where the two halos intersect are also well known, but with the sun as high as 45° they would be expected to lie a little outside the 22° halo on the white circle. The other mock sun on the eastern side of the horizontal white circle is more rare; it may coincide with the point where a larger halo cuts the horizontal circle, but the laws determining the formation of this halo and

its exact position are not known, and portions of it have been seen on only three or four occasions of which we have any record.

The last item in the sketch, the coloured semicircle rising from the south-eastern horizon to almost touch the horizontal circle, I am unable to suggest any explanation for. The sketch is evidently reversed, as in it this and the white mock sun are shown on the western side. In recording observations of coloured halos, mock suns, &c., it would greatly add to their values if notes were made of the arrangement of the colours, such as "red inside, blue outside halo," "red next sun, blue away from it," and *vice versa*.

R. T. OMOND.

Scottish Meteorological Society, Edinburgh, May 17.

### Mathematical Training.

IN view of the great influence which Schopenhauer has exerted on German thought, I referred to his chapter on mathematics, and find that half a century ago he was even more sweeping in his condemnation of the methods of Euclid than are some of your present correspondents. He mentions that the exact sciences are confined to those dealing with time, space and causality, or without being too precise as regards names, the exact sciences are arithmetic, geometry and logic. Schopenhauer's view is that each of these sciences is independent of the other, and he illustrates this by saying that mathematically it is just as self-evident that two parallel lines cannot meet as it is logically self-evident that an impossibility is not possible. He strongly objects to our aping the Greeks and basing mathematics on logic, and I feel sure that he would consider that mathematics were being degraded by the excuse so often given for teaching it at all, that "Euclid is an invaluable logical training." If I understand him correctly, Schopenhauer holds that any mathematical proposition is as self-evident as any correct logical sequence, and only requires illustrations or explanations (not proofs) to make this clear to our somewhat imperfect brain. This he might have illustrated by the Pythagorean proposition, which can be shown to be correct without the elaborate logical scaffolding used by Euclid, provided that one's mind can grasp the proportionality of similar triangles. Let  $a, b, c$  be the lengths of the sides of a right-angled triangle, draw a perpendicular from the apex intersecting the hypotenuse  $c$ , and divide it into two lengths  $d$  and  $e$ . We then have three similar right-angled triangles and the following two sets of proportions:—

$$\frac{c}{a} = \frac{a}{e} \text{ and } \frac{c}{b} = \frac{b}{d}$$

from which it follows that  $a^2 = c \cdot e$  and  $b^2 = c \cdot d$ , and as  $d + e = c$ , we have  $a^2 + b^2 = c^2$ .

Most other propositions, if not self-evident, might be dealt with in the same way; and if we were as gifted as Newton was, we would, as he did, wonder why anybody should trouble to demonstrate the, to him, quite self-evident truths in Euclid.

In our public schools we are taught classics, not because of the logic they contain, for it is often wrong, but because they exercise our memory (and, I fear, cripple our reasoning powers), and we teach mathematics, not to improve our knowledge of space, but to improve our logic and sometimes also to improve our memory. Naturally our views about space are often hazy, and our reasoning powers, which receive no direct training, are not infrequently stunted, or rather compelled to work in narrow grooves.

C. E. STROMEYER.

Lancefield, West Didsbury, May 12.

### Influence of Light upon Plant Assimilation.

I HAVE for some time been endeavouring to devise a simple and cheap apparatus for demonstrating the effect of red and blue light respectively upon the assimilatory power and nyctitropic movements of plants. The apparatus usually supplied by the dealers for this purpose consists of a double-walled bell-jar into which a solution of potassium bichromate or of ammoniacal copper sulphate may be poured. This is a rather expensive piece of apparatus for school use, especially if a large one is required. I have not been able to find a blue or red glass that absorbs blue or red light only. I have tried home-made glass cells about a foot square and a quarter of an inch internal diameter, but could not prevent leakage. Perhaps some reader of NATURE could help me. Is there a transparent coloured paper or some kind of coloured membrane that would serve the purpose?

E. E. HENNESSEY.

Bigods School, Dunmow, Essex, May 19.