

to be paired by a true cock ostrich. This particular ostrich was a hen, although she had every appearance of being a cock. What explanation could you give as regards this incongruity?

"(3) About six months ago I found a peculiar bird's nest suspended from the root of a mimosa tree which overlapped a bank of ground. Before going further, I must first tell you that previous to the occasion in question I noticed the same peculiar form of nest, but it seemed so utterly impossible at the time that it could be a nest, since its structure and mode of suspension had the exact characteristics of a certain structural spider's web, that I passed it by. But on the second occasion, to make absolutely sure that I had not made a mistake, I went up and cut the nest off, with a certain length of the root to which it was attached. Imagine my surprise, when I saw that it was really a bird's nest with two eggs. Now this nest was a perfect facsimile of a common spider's web and home, found in the locality where I was at the time staying.

"Since it was a marvellous imitation of an insect's habitat, there must have been some corresponding necessity for such imitation. Either the nest must have been designed and constructed, so as to delude enemies by which the species was liable to be attacked, or, it was so imitated, that the materials of which the nest was made should serve as a bait, and allow the parent birds to be able to feed their young without the necessity of having to leave the nest, and so be unable to protect their young for the time being. The materials from which the nest was made were practically webs abandoned by their original owners. It was an instance of perfect imitation."

#### Astronomical Photography.

THE announcement (NATURE, August 10), that it is in contemplation to raise a sum exceeding £2000 for the establishment of a special photographic telescope at the Cambridge Observatory, leads me to ask whether astronomers have duly considered the facilities afforded by modern photography. At the time of my early experience of the art, thirty-five years ago, it would have been thought a great feat to photograph the Fraunhofer lines in the yellow or red regions of the spectrum, although even then the statement so commonly made that chemical activity was limited to the blue and ultra-blue rays was quite unwarranted. With the earlier photographic processes the distinction was necessary between telescopes to be used with the eye or for photography. In the former case the focal length had to be a minimum for the yellow rays, in the latter for the blue rays of the spectrum.

But the situation is entirely changed. There is now no difficulty in preparing plates sensitive to all parts of the spectrum, witness the beautiful photographs of Rowland and Higgs. I have myself used "orthochromatic" plates in experiments when it was desirable to work with the same rays as most influence the eye. The interference bands of sodium light may be photographed with the utmost facility on plates sensitised in a bath containing cyanin.

The question that I wish to ask is whether the time has not come to accommodate the photographic plates to the telescopes, rather than the telescopes to the plates. It is possible that plates already in the market may not exactly meet the requirements of the case, but I feel sure that a tithe of the sums lavished upon instruments would put us in possession of plates suitable for object glasses that have been designed for visual purposes. There would be no difficulty even in studying the requirements of a particular instrument, over or under corrected as the case might be.

A doubt may arise whether plates so adjusted would be as sensitive as those now in use. Probably Captain Abney, or some other authority, could give the required information. For some astronomical purposes a moderate loss of sensitiveness could hardly be of much consequence; for others doubtless it would be a serious matter.

RAYLEIGH.

Terling Place, Witham, August 15.

#### The Discussion on Quaternions.

I HAVE followed with much interest the discussion on quaternions which has with more or less intermission been going on in NATURE for a long time.

It has always appeared to me that the student of physical science would better employ his time by studying the "Ausdehnungslehre" to which some of your correspondents have referred than by studying quaternions.

The wonderful work of Grassman is contained in a moderate-sized book in remarkable contrast to the two terrific volumes of Hamilton, which even Prof. Tait admits that he has not read entirely. The fact that the *ausdehnungslehre* could be mastered in a mere fraction of the time that would have to be devoted to the mastery of quaternions, is not however the important point.

The *ausdehnungslehre* seems to afford a symbolism more fitted for the expression of many recondite conceptions in physics, than anything which quaternions has to offer. Even the "Nabla" does not insinuate itself into Nature's secrets more cunningly than does the "Inneres Produkt."

Perhaps I may give an instance, which if elementary will at all events illustrate the extraordinary directness with which the different kinds of "product" reach the heart of a physical conception.

Think of a mechanical system of any kind which possesses but a single degree of freedom, think of any system of forces whatever applied to that system, and consider the question of equilibrium. The possible movements of the system form twists about one screw chain, the system of forces form a wrench upon another screw chain. Equilibrium will subsist if, and only if, the "Inneres Produkt" of the two screw chains is zero. Suppose any system whatever possessing  $n$  degrees of freedom. Dynamics teaches that mutually destructive twist velocities can be imparted to any  $n + 1$  screw chains about which the system can twist. Does any conceivable symbolism assign those twist velocities more beautifully than the *ausdehnungslehre*? Each twist velocity is the "Kombinatorisches Produkt" of all the screw chains to which it does *not* correspond.

The aptitude of other conceptions of this grand calculus for physical problems could be as readily exemplified. But I forbear. Why has not some one ere this translated into English "Die Ausdehnungslehre von Hermann Grassman" 8vo, pp. 388, Berlin 1862?

ROBERT S. BALL.

Observatory, Cambridge, August 18.

#### A Curious Optical Phenomenon.

DR. LAUDER BRUNTON has asked me to give you an account of a very curious phenomenon witnessed from the top of Gausta mountain (height 6000 Norwegian feet) in Telemarken, south of Norway.

We were a party of two ladies and three gentlemen on the summit of this mountain on August 4.

On the morning of that day the sky was passably clear; at noon there was a thick fog. Between six and seven o'clock in the afternoon (the wind being south to south-west) the fog suddenly cleared in places so that we could see the surrounding country in sunshine through the rifts. We mounted to the flagstaff in order to obtain a better view of the scenery, and there we at once observed in the fog, in an easterly direction, a double rainbow forming a complete circle and seeming to be 20 to 30 feet distant from us. In the middle of this we all appeared as black, erect, and nearly life-size silhouettes. The outlines of the silhouettes were so sharp that we could easily recognise the figures of each other, and every movement was reproduced. The head of each individual appeared to occupy the centre of the circle, and each of us seemed to be standing on the inner periphery of the rainbow. We estimated the inner radius of the circle to be 6 feet.

This phenomenon lasted several minutes, disappearing with the fogbank, to be reproduced in new fog three or four times, but each time more indistinctly.

The sunshine during the phenomenon seemed to us to be unusually bright.

Mr. Kjelland-Torkildsen, president of the Telemarken Tourist Club, writes to me that the builder of the hut on the top of Gausta has twice seen spectacles of this kind, but in each case it was only the outline of the mountain that was reflected on the fog. He had never seen his own image, and he does not mention circular or other rainbows.

A. WILLE.

Christiania, August 15.

#### Supposed Suicide of a Rattlesnake.

THE letter of Mr. E. S. Holden, of the Lick Observatory, in your issue for August 10, describing how a rattlesnake struck