of some facts which appear to have escaped the notice of biologists; for example, the truism I have mentioned, that, apart from variations, offspring tend to recapitulate the development of their parents.

G. ARCHDALL REID.

9 Victoria Road South, Southsea.

Solar Eclipse Results and the Principle of Relativity.

ON a recent occasion I read a paper before the Manchester Literary and Philosophical Society on the nature of dimensions, in which, admitting the possibility and even probability of space and time having secondary characteristics, like those suggested by Lorentz and Einstein, reasons were given for doubting whether the methods employed for finding them could be relied on, and experimental evidence, before it could be accepted, would have to be subjected to searching adverse criticism. Prof. Eddington's solar eclipse results were therefore submitted to a process essentially the reverse of his, which had for object not the confirmation of a theory, but the discovery of an empirical relation. During this process it soon became evident that the astigmatism of the cœlostat mirrors, which had given much trouble during the eclipse by distorting the star images, had also affected the field and altered the star positions. The stopping down of the objectives aggravated this evil in a double sense: first, the reduction of the star-image astigmatism makes it impossible to construct a picture of what might be called the field astigmatism of the mirrors; and, secondly, the smaller the diameter of the pencil of light rays for each star, the further apart would be the regions on the mirror from which these pencils were reflected. Therefore, if the various regions of the mirror had semi-independent tilts, the places of the stars on the plates would be affected by these tilts. If for some of the existing plates these pencils should be found to overlap, and if the star-image astigmatism is sufficiently marked, then these plates might still be used for the object for which they were taken.

Wishing, first of all, to redetermine the positions of the stars as they appeared before scale corrections had been applied in order to trace the wandering of the images, it was found that for the outermost stars 10 and 11 these negative corrections would amount to 0·45″. This in itself was a most disconcerting discovery, for the difference of displacement on which the eclipse conclusions were based is only 0·75″. It is, of course, quite impossible for the telescope tube to have altered sufficiently in four and a half minutes to produce this result, and a change of focus of the objective would have had no effect; therefore the mirror must have warped even during this short time. At Principe the passage of clouds would produce an irregular warping effect, and this would account for the unsatisfactory photographs obtained there. In order to form some idea about the nature of the field astigmatism it was now decided to estimate the tangential displacements of the stars, for these would not be influenced either by the scale corrections or by the radial displacements, but only by the mirror warpings. It was then found that stars 3, 4, and 6, which lie almost in a straight line between 5 and 10, had moved about 0·45″ across the connecting line of these outer stars. On averaging the uncorrected radial displacements it was found that a slight scale correction of about +0·0002″ had to be made, as was done by Prof. Eddington, in order to harmonise them with the Einstein estimates, the excuse in my case being that the mirror may have acquired a slight temporary concavity. If, however, there was a temporary convexity, necessitating a scale correction of, say, −0·0003″, the displacements would appear to conform to the empirical formula 1·09″ − 0·00022″. It will thus be seen that the use of cœlostat mirrors is not advisable where, as under eclipse conditions, rapid changes of temperature are unavoidable.

C. E. STROMEYER.

"Lancefield," West Didsbury, July 21.

MR. C. E. STROMEYER greatly exaggerates the possible effects of astigmatism of the cœlostat mirrors on the positions of the star images. He appears to consider that the pencils forming the different images are reflected from entirely different portions of the cœlostat surface. As a matter of fact, with the 4-in. lens the pencil producing the extreme star image was reflected from a portion of the mirror which had 85 per cent. of its area common to that producing the central pencil, and with the 13-in. lens (stopped down to 8 in.) the common portion was even greater.

That there was a slight astigmatism of the mirrors is not denied. Its presence was indicated by small differences in the scale and orientation constants of the plates determined in two different ways: from the right ascensions or declinations. These differences gave a measure of the amount of the astigmatism, and showed it to be very small and of very slight effect on the gravitational displacement. The question has been fully discussed by Prof. H. N. Russell (Monthly Notices, R.A.S., vol. lxxxi., No. 2, December, 1920), with the result that the conclusions deduced from the original reductions of the eclipse plates were fully substantiated and the Einstein displacement confirmed.

F. W. DYSON.

The Atomic Radius and the Ionisation Potential.

PROF. EVE'S interesting contribution to NATURE of June 30, p. 552, on the relation between the ionisation potential and the atomic radius induces me to publish certain similar ideas of mine on the same subject to which I referred some time ago before the Royal Society in some remarks on Prof. Rankine's paper "On the Proximity of Atoms in Gaseous Molecules" (Proc. Roy. Soc., February, 1921). I did not publish the results, because I desired to wait for further data. These ideas may be stated as follows:—

According to the Rutherford-Bohr model of the atom, by the radius of the atom is meant the distance from the nucleus of the outermost electron, *i.e.* the electron the quantum vibrations of which cause the radiation of the arc lines of the atom. Sommerfeld has shown that in the normal (unexcited) state the orbit is characterised by the azimuthal quantum-number unity and the radial quantum-number zero. This orbit is circular, but to calculate its radius we must know what is the field of force exerted by the central nucleus and the remaining $(n-1)$ electrons upon the vibrating electron. This is at present an insoluble problem, but Mr. S. N. Basu (*Phil. Mag.*, November, 1920) has shown that we can at least arrive at a qualitative explanation of Rydberg's laws of spectral regularity by assuming the attracting system to be equivalent to a net central charge unity, with a doublet of strength L. On the bases of this theory, if a_x is the radius of the monoquantic orbit, it is easy to show that

$$\frac{e^2}{2a_x} = -\text{energy of the vibrating electron.}$$
$$= h(1s) \text{ where } (1s) = \text{convergence frequency of the principal series of the element in absolute measure.}$$
$$= eV_x,\ V_x = \text{ionisation potential in } e.s. \text{ units.}$$

For the H-atom we have, according to Bohr's theory;