correspondence between isotopic numbers which differ by 4, or by the formula p_4e_4, which may be assumed to represent an α-particle *plus* two cementing or β-electrons. The relations of the light atoms are thus very similar to those of the radio-active atoms.

It may be of interest to note that during an α-change there is no change in the isotopic number; in a β-disintegration the isotopic number decreases by 2. Of these two units one is due to the decrease of the number of negative electrons in the nucleus by one, and the other to the resultant increase of the atomic number (M) by one. The addition of a proton to a nucleus would increase the atomic number and decrease the isotopic number by one each. Thus the addition of a positive electron to the nucleus of Mg 12_2^{26} would give 13_1^{27}, which is ordinary aluminium.

The negative electrons in atom nuclei seem to be usually associated in pairs. Thus in the β-disintegrations of the radio-active elements two electrons escape in succession. This pairing may explain the fact that while most atoms have the formula $(p_2e)_M$, with M an even number, extremely few have the same formula when M is odd. Thus if p_2e should prove to be the primary group in atom-building, nevertheless the most abundant group in existing nuclei would be expected to have the formula (p_2e) or that of an α-particle.

WILLIAM D. HARKINS.

University of Chicago, February 4.

Light and Electrons.

WITH reference to Sir Oliver Lodge's letter in NATURE of April 7, some few weeks ago I fitted a flat speculum mirror to a centrifuge capable of being run at 150 revolutions per second. The other arrangements—not yet completed—are as follows:—The image of a brightly illuminated slit is focussed on the mirror; a second slit is placed at a distance of about 10 metres.

(1) The eye is placed behind the second slit and the centrifuge increased in speed until the flash is no longer seen. If the slits are 1 mm. wide a duration of flash of 10^{-7} sec. is attainable. If necessary, the radius of the rotating beam may be increased.

(2) The eye is replaced by a photographic plate. This is a test for electrons released from the sensitiser. Below a certain duration of flash there should be no latent image formed, however often the flash is repeated.

(3) A light-sensitive photo-electric cell is also tested.

In this manner Mr. J. H. Poole and I have planned to test the very point raised by Sir Oliver Lodge, and also to seek for evidence respecting the quantum theory of vision.

At present there is only this much to go on. It is stated (Halliburton's "Physiology") that a flash of $1{\cdot}25\times10^{-7}$ sec. duration is still visible. This (if it is the limit) affords a length of 4×10^{3} cm. for the length of the train of waves activating an electron in the retina. If it is allowable to go further we find the energy of a single wave (of green light) to be about 6×10^{-20} erg.

J. JOLY.

Trinity College, Dublin, April 8.

Molecular Structure and Energy.

THE question which Prof. Partington raises in his letter under the above title in NATURE of April 7, p. 172, is an important one which I would prefer should be answered by others more qualified to do so than myself. I intervene principally to correct the impression given in the letter that the structures of the various molecules with which I have dealt in recent communications have been proposed by me. This is not so. All that I have done is to show that the structures of certain polyatomic molecules, including some halogen gases, carbon dioxide, and nitrous oxide, postulated by Lewis and Langmuir are consistent with viscosity data and X-ray crystal data taken together. The procedure deals with the *external* shapes of the molecules only, and not with the internal energy of their nuclei; and it appears to be justified by the calculations of Prof. S. Chapman (Phil. Trans., vol. ccxvi., p. 347), who says: "... the internal energy which prevents the application of our formulæ to the conductivity of polyatomic gases hardly affects viscosity."

Prof. Partington's views appear to be open to criticism even if we leave out of account entirely the necessity for revising earlier ideas of energy partition on the basis of the quantum theory. For example, Langmuir's proposed structure for the nitrogen molecule is not spherically symmetrical in the same sense as are the atoms of the inert gases. There are *two separate* massive nuclei instead of one, and this involves the possibility of rotational internal energy of the same type as in the oxygen molecule, so that the ratio of the principal specific heats could not be expected to be so high as 1·667. Also, is it not possible, indeed probable, that the nuclei of all polyatomic molecules are capable of vibration to and fro? Such motions are, I believe, known to exist in the gaseous hydrogen halides, as well as the rotations to which attention has recently been directed by Prof. W. L. Bragg and Mr. H. Bell (NATURE, March 24, p. 107).

A. O. RANKINE.

Imperial College of Science and Technology, April 7.

The Normal Orbit of the Electron in the Atom of Mercury.

RESEARCHES on ionisation and resonance potentials of mercury vapour and on its ultra-violet absorption in a non-luminous state, together with considerations from the serial type of the mercury spectrum, lead to the definite conclusion that in the absence of exciting agencies the spectral electron remains on the orbit 1S, the normal orbit of the atom of mercury. On the other hand, R. Dearle has shown the presence of a strong infra-red absorption band at $\lambda=10140$, and this fact has suggested the possibility of a second normal orbit in the mercury atom, namely, the orbit 2P. The corresponding ionisation and resonance potentials have, however, never been observed. This problem induced us to make an absorption experiment with non-luminous mercury vapour in the infra-red region, using a photographic method which enabled us easily to reach $\lambda=11300$ Å. All the photographs showed complete absence of a marked absorption at $\lambda=10140$, although the pressure of mercury vapour reached 1 atm. The efficiency of the method having been established, the absence of a strong and characteristic absorption of $\lambda=10140$ by mercury vapour has been shown and the necessity for a second normal orbit is avoided.

A. TERENIN.

Optical Institute, Petrograd, December, 1920.

Doublets in Spectral Series.

THE physicists of Petrograd have recently become acquainted with a paper by Wood and Mohler (*Phil. Mag.*, April, 1919) on resonance in sodium vapour.