elastically scattered electrons are detected, it appears as if the atoms were surrounded by large opaque fuzzy-edged disks, or shadows, since almost no elastically scattered electrons can appear at small scattering angles. It is these disks which are responsible for the diffraction effects.

It is clear by comparison with light diffraction that diffraction effects become easier to observe when the diffracting object is not very large compared with the wavelength of the diffracted beam. So it is not surprising that shadow diffraction has remained undetected for so long. The experimental techniques necessary for its observation are more difficult than for large angle scattering, and there was no theoretical prediction.

The apparatus used by Geiger and Morón-León is similar to an electron microscope in which the specimen is replaced by the target gas at a pressure of about 0.1 Torr. A diminished electron optical image, 8 μm in diameter, of the cathode is formed in a filter lens. This is so arranged that all electrons which have lost energy by any inelastic collision with the target atoms see a potential hill which they cannot surmount, and so fall back; that is, they are reflected by the filter lens. The remaining elastically scattered electrons are imaged by the filter lens onto a photographic plate.

Measurements were made in helium, neon and argon. Typical results obtained with neon are shown in the figure, from which it is clear that the diffraction effects are more pronounced at lower energies. The well-known Born approximation, which is flat over this narrow angular range, is used for normalisation purposes. The orders of the diffraction minima are numbered. Geiger and Morón-León assume that the radius R of the disk is equivalent to a 0th order diffraction maximum of angular full width at half height$\theta = \Delta E/E$ where ΔE is the energy lost by the inelastically scattered electrons of primary energy E. This gives an energy dependent radius R of the disk given by $R = 2/k\theta$, where k is the wavenumber of the incident electrons. In the case of the 15 keV electrons scattered from neon, if it is assumed that the main energy loss, ΔE, is due to excitation of the resonance line at 16.9 eV, the radius of the scattering disk is 30 Å, or some 23 times larger than the kinetic theory atomic radius. This agrees exactly with the value of the radius which can be obtained by substituting the measured minima shown in the figure in the Fraunhofer diffraction equation. Good agreement is also obtained in all other cases, where the diffraction angles are not so accurately measureable. So the remarkably simple model of an opaque shadow disk without a fuzzy edge gives an excellent explanation of the observations.

Clearly shadow diffraction now awaits a more detailed theoretical treatment, preferably including electron spin effects. Rapidly changing intensities are an indication that spin polarisation effects are to be expected. For example, in addition to the spin polarisation measurements discussed above, electrons elastically scattered in the neon resonances were shown to be polarised by Franzen and Gupta in 1965. Since spin-up and spin-down electrons could see a different-sized shadow, shadow diffraction may well produce polarised electrons where the intensities are by no means small. □

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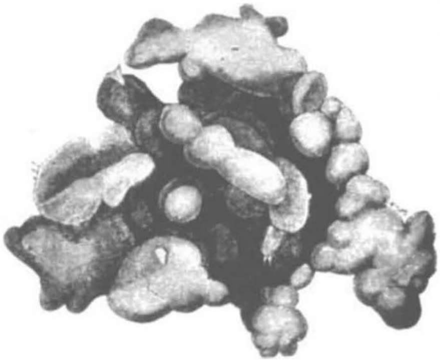
NATURE

100 years ago



THE eminent zoologist, Dr. Karl Moebius, of Kiel, has recently published a treatise, "Der Bau des *Eozöon canadense* nach eigenen Untersuchungen verglichen mit der Bau der Foraminiferen" ("The Structure of *Eozöon canadense*, according to my own Investigations, compared with the Structure of Foraminifera"), which first appeared in the "Palaeontographica" (vol. xxv.), and was afterwards republished separately. Prof. Moebius inclines entirely towards the view of King and Rowney (*Proc. Roy. Irish Acad.* ser. I, x. and ser. 2, i.) disputing the organic character of Eozöon. . .

According to Dr. Moebius *Eozöon canadense* consists principally of alternate layers of yellowish green serpentine and whitish limestone. . .

"If the Eozöon pieces from the Laurentian or 'Urgneiss' formation were really remains of an undoubted foraminifera species, then we should possess in them *certain* proofs that even during the formation of the most ancient strata of the earth's crust living beings occurred, and that the first organisms belonged to the lowest animals, by which biology and geology would have gained two highly important facts. Yet by the scientifically justified elimination of Eozöon from the domain of organic beings it is not proved that during the Laurentian period no living beings existed. Perhaps the graphite of the Urgneiss formation has its origin in organic beings."

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