these elements. As mentioned in our previous letters, however, the two lines ascribed by Dauvillier to the element 72 were lying 4 X-units distant from our Hf-lines, which is distinctly more than the limit of experimental error,¹ whereas the lines of the elements 70 and 71 measured by Dauvillier (*Comptes rendus*, vol. 174, p. 1347, 1922) on the same plates closely agree with the measurements of the same elements obtained by Coster (*Phil. Mag.*, vol. 44, p. 546, 1922). As the two lines according to Dauvillier were extremely faint, they may easily be explained to be of some other origin.

It is of interest to note that, at various times, announcements have been made as to the complexity of zirconium. In 1845 Svanberg claimed that in decomposing zircons he discovered a new element "norium," with a lower atomic weight than zirconium. His and Sjögren's (1853) statements were later disproved by the work of several investigators including Marignac. In 1864 Nylander reported the existence of two earths in zirconia. Five years later, by a spectroscopic investigation of zirconium, Sorby was led to announce the discovery of "jargonium" and Church of "nigrium." Finally, in 1901 Hofmann and Prandtl thought that they had found in euxenite a new element related to zirconium. It is also interesting to note that Mendeleeff, as we learn from Sir T. E. Thorpe's letter in *NATURE* of February 24, p. 252 (March 17), suggested that the extraordinarily discordant values for the atomic weight of titanium, found by several chemists, might be due to the presence of a homologous element of higher atomic weight in their material. Whether these statements in some cases may be explained by the presence of hafnium in the minerals and preparations under investigation, it is not easy to decide. The intricate chemistry of zirconium, and the great chemical similarity of hafnium with this element, would in fact have made any establishment of hafnium very difficult before the development of the powerful method of X-ray analysis.

D. COSTER.
G. HEVESY.

Universitetets Institut for teoretisk Fysik,
Copenhagen, March 20.

Constitution of Black Maketu Sand.

THE letter of Messrs. Smithells and Goucher in *NATURE* of March 24, p. 397, under the above title calls for a short reply from me.

The authors do not state with what object their experiments were made, but the results of these differ so much from my own as to suggest that the sand examined by them was from another part of the deposit at Maketu, or possibly from an entirely different source, such as that on the Taranaki Coast.

Is "Prof. Bohr's conclusion that no new element is present" to be found in any paper published by him? If not, it would be interesting to know upon what authority the authors quote it.

As my original communication on this subject was made to the Chemical Society, I feel it my duty to send to the Society, in the first place, the results of my own further experiments and also those of the examination of my preparations by Drs. Coster and Hevesy. This I hope to be able to do in time for publication in the Society's Journal for April.

ALEXANDER SCOTT.

34 Upper Hamilton Terrace, London, N.W.8,
March 26.

¹ Dauvillier's measurements carried out since the announcement of our discovery, on other material which possibly contained hafnium, have already led him to give new values for the same wave-lengths, which are respectively 3.4 and 2.3 X-units larger (*NATURE*, February 17, 1923).

Tracks of α -Particles in Helium.

IN a recent issue of *NATURE* (January 27, p. 114), Messrs. Ryan and Harkins have published some photographs of the ionisation tracks of recoiling atoms produced by collision of α -particles with air molecules. We have been also engaged in photographing the tracks of α -particles from polonium in helium, and have obtained some interesting photographs. Besides the long range recoil helium atoms, we have obtained a few photographs in which are shown the ionisation tracks of all the constituent parts of a helium atom, namely, of the nucleus and the two bound electrons. They are shown in Fig. 1 (i and ii).

FIG. 1.

It will be noticed that both the electrons are ejected on the same side of the α -particle track. One of us (D. Bose, *Zeit. f. Phys.*, 12, 207, 1922) has previously photographed the ionisation tracks of several thousands of α -particles in hydrogen, and in no case was a photograph obtained which showed simultaneously the ionisation tracks of the two constituents of a hydrogen atom. This behaviour can well be explained on the model of the normal helium atom proposed by Lande and others, according to which the two electrons move in orbits which are inclined to one another. If an α -particle strikes the atom at the moment when both the electrons are near the point where their orbits cross, then the probability of their both being ejected in the same direction is very great.

The photograph (Fig. 1, iii, a) presents some special points of interest. In it is shown (1) the track of the α -particle before and after collision, (2) that of a recoiling nucleus, (3) four small tracks which radiate out from the circular patch and are due to the electrons which are ejected from the atom under collision. The circular patch, which is absent in the photographs of other recoiling atoms, resolves when seen under high magnification into a number of lines radiating from a centre. An enlarged photograph which has been slightly retouched is reproduced in (iii, b). It will be noticed also that the path of the recoil atom is very much curved in the beginning—a phenomenon we have not observed before in the many tracks of the recoil atoms which we have obtained in air, hydrogen, and helium. Its length is 4 cm., and is larger than any of the other recoiling atom tracks which we have obtained in helium.

Judging from the number of the electrons which have been emitted we have here evidently the collision of an α -particle with an atom more complex than either hydrogen or helium; we can suppose it to be either nitrogen or oxygen; such atoms can well be expected to be present as impurities. But it is difficult