cules of a gas and to produce photochemical action. The number of ions produced per unit length along the path of the α particle has its maximum very near the point where it loses its ionising power. The β particles, however, are almost completely scattered in the first thin layer of matter, and inside it the radiation broadens out in all directions, and any trace of the direction of the impinging rays is soon lost.

In the aurora, according to Birkeland's theory, we are actually examining the luminosity produced when the electric radiation strikes the upper strata of the atmosphere, and from the form and structure of the luminosity we should be able to examine the way in which the solar radiation is absorbed by matter.

One of the most conspicuous forms of aurora are the draperies, of which an illustration is given in the accompanying figure. We notice the straight-lined structure. That the draperies are formed by something coming towards the earth from outside will be evident to all who have witnessed their formation. On March 27, 1910, the writer had the opportunity of examining a most brilliant aurora from the mountains of "Jotunheimen." Brilliant draperies were formed, and they could be seen actually falling down in the direction of the streamers, one bundle adding itself to another in rapid succession so as to form long spirals and bands. Now the structure of the luminosity is just as would be expected if the draperies were formed by a type of rays showing an absorption like that found for the α rays. Looking at the luminosity along the transverse streamers, we shall always notice that the intensity gradually increases downwards, but stops all of a sudden, just as it is found for the ionisation produced by an α particle along its path.

I do not mean to say that it is exactly α rays or charged helium atoms which produce draperies, but I think that the similarity in absorption strongly points to a similarity in type of radiation—in other words, that the rays producing the draperies are of atomic size and carry an electric charge.

The fact that the draperies occur mostly on the evening and night side of the earth should, according to the law of the magnetic deflection, require a negative charge of the rays; but such rays may well be possible, for, as we know, Sir J. J. Thomson has found that accompanying the positive rays in a vacuum tube there are other rays formed by atoms, but carrying a negative charge.

In view of the fact that a number of the same spectral lines are found in the corona and the aurora spectrum, which belong to the rare gases, it would be natural to suppose that these inert gases, *e.g.* argon, neon, xenon, krypton, helium, and possibly coronium, are forming the carriers of the "electric radiation" producing the draperies.

The existence of such radiation does not in any way exclude the existence of corpuscular rays; these may be the cause of the auroral "arch," which has just the diffuse appearance to be expected from the law of absorption of the β rays. Further, the magnetic disturbances may to a great extent be due to radiation of the β-ray type.

L. Vegard.

University of Christiania, March 16.

The Velocity of Earth Movements caused by the Messina Earthquake.

I am deeply indebted to Prof. J. Milne, F.R.S., who, in Nature of March 23, did me the honour of directing the attention of scientific men to my memoir on the velocity of earth movements caused by the Messina earthquake. As the notice contains some remarks on my work which require a little explanation, I beg to be permitted to state my views here.

According to some seismologists, the position of the hypocentre is at the intersection of an asymptote to Schmidt's hodograph, with a vertical ordinate drawn through its apex. It seems to me, therefore, that the absence of any measurable flexure in the curves may really mean that the hypocentre of the Messina earthquake was very shallow. That is, however, a matter of opinion about which seismologists can easily be divided, and I have no desire to insist on this subject.

Prof. Milne assumes that I divided the large-wave phase of the seismograms into three parts, called L_1, L_2, L_3, being L_1 the commencement of maximum motion, L_2 the maximum movement itself, and L_3 the phase which travels the slowest. He adds that if this is to be accepted as a definite and recognisable phase in a seismogram, there seems to be no reason why we should not also accept many other phases, which may be indicated by the letters L_4, L_5, L_6, &c. The remark is of interest, but I deserve neither praise nor blame for the division of the large-wave portion of seismological registrations. Prof. Milne well knows that the division of the principal portion of a seismogram into six groups was done by Prof. Omori, analysing the registrations obtained at Tokio, and such a division is now accepted by almost all seismologists. In my memoir, L_1 indicates the commencement of the initial phase; L_2 and L_3 are respectively the commencements of the slow-period and of the quick-period phases of the principal portion of the registrations, according to Prof. Omori's division.

Instead of considering as a whole the large-wave phase, which involves some uncertainty (as often the commencement of the principal portion is assumed to be on Omori's initial phase and at other times the commencement of the same principal portion is referred to the slow-period phase), I tried to distinguish in all seismograms the first three groups of the large-wave phase, L_1, L_2, L_3. I am not dissatisfied at having done this, because I have obtained some results which I think are not without importance for physical seismology.

I conclude by expressing my warmest thanks to Prof. Milne for his notice and for the valuable article on the necessity of restoring the Messina Observatory contributed by him to Nature of February 16.

Messina, March 30. G. B. Rizzo.

FROM THE NIGER TO THE NILE ACROSS AFRICA.[1]

Dr. Karl Kumm (whom, from the indirect statements made in his book, we take to be of Swiss origin, and who now seems to be for all practical purposes an Englishman) assisted to found the Sudan United Mission in 1907–8. This mission was expressly intended to work in the Nigerian and Egyptian Sudan to counteract the Moslem advance, and Christianise the pagan tribes of negroes not as yet influenced by the Muhammadan religion. His previous acquaintance with Africa (according to the statements made in his "exordium") has been considerable. In 1899 he had visited "the southern oases of the Libyan Desert," and had travelled a considerable distance on the way to Darfur. In 1901 he travelled in Nubia. In 1904 he journeyed from Tripoli southwards into the mountainous region north of Fezzan and studied the Hausa language. In 1904–5 he led an expedition of investigation into northern Nigeria. In the two following years he visited America and South Africa to arouse interest in his mission and secure data as to the advance of Islam in the direction of the Zambezi. On his return from South Africa he visited Portuguese East Africa, Mombasa, and made a hasty journey to Uganda.

In October, 1908, he left Liverpool with seven missionaries of the newly formed Sudan United Mission to visit or to found mission stations in northern Nigeria, and establish a home for freed slaves. He further intended, if practicable, to cross Africa along the border-line between Islam and paganism.

The book under review is the result of this last journey, which extended from Forcados, at the mouth of the Niger, along the course of the Benue to the Musgu country on the Shari, thence up the Shari River to Fort Archambault, and from that point along the line of water-parting (more or less) between the Shari, the Congo, and the Nile. He emerged into some-

[1] "From Hausaland to Egypt, through the Sudan." By Dr. H. Karl W. Kumm. Pp. xiv+324. (London: Constable and Co., Ltd., 1910.) Price 16s. net.