the corpuscular radiation is small. For a slightly more penetrating primary beam a rapid increase in the intensity of both the secondary Röntgen radiation and the corpuscular radiation takes place. This seems to suggest that the production of corpuscular radiation is in some way intimately associated with the emission of the Röntgen type of radiation.

(2) I had recently shown that when homogeneous radiation falls upon a thin layer of a substance which may act as a secondary radiator, a portion is transmitted unchanged, and that the fraction of the remaining energy which is transformed into secondary Röntgen radiation *decreases* as the primary beam becomes more penetrating. In the present experiments it is found that the corresponding fraction of the remaining energy which is transformed into corpuscular radiation *increases* as the primary beam becomes more penetrating.

(3) The corpuscular radiation emitted by these metals when subjected to homogeneous beams is itself surprisingly homogeneous, whether the exciting beams are "soft" or very "hard."

(4) The absorption coefficients of the corpuscular radiation from a given metal excited by homogeneous secondary Röntgen radiation vary with the nature of the exciting radiation. These absorption coefficients are a decreasing linear function of the atomic weight of the secondary radiator.

I hope to publish further details of these experiments shortly.

CHARLES A. SADLER.

George Holt Physics Laboratory,
Liverpool University.

Drought in South-west Ireland.

THE deficiency of rainfall in the south of Ireland, to which Mr. Armstrong refers in *NATURE* of October 21 (p. 487), has been apparent in the annual total rainfall for the last three years, the deficiency also affecting the south-west of England. At the same time, there has been a marked excess of rainfall in the north of Ireland, deficiency and excess being taken as synonymous with quantities below and above the average of many years. It is frequently found that parts of the country, often quite narrow strips, show a marked deficiency of rainfall for several successive years, and afterwards revert to an average condition or show an excess. The most probable explanation seems to me to be a change, perhaps a slight one, in the prevailing tracks of the centres of barometric minima, but I have not found data in a form suitable for testing the truth of the suggestion.

The extreme dryness of August was experienced over a large area of the south of Ireland, less than half an inch of rain having fallen over about 2800 square miles. In September less than half an inch fell over not more than 500 square miles.

I may perhaps be excused for pointing out that while Mr. Armstrong uses "absolute drought" to describe a period of twenty-four hours without rain, it has been usual for many years to reserve the words "absolute drought" for a period of more than fourteen consecutive days without recorded rainfall.

HUGH ROBERT MILL.

62 Camden Square, London, N.W., October 25.

Derivation of the Word "Theodolite."

ALTHOUGH the etymology of the word theodolite has been discussed from time to time,¹ no satisfactory solution has hitherto been established. It was first used in England, and the earliest reference to it is contained in a book by Leonard Digges (completed and published by his son, Thomas) called "Geometrical practical treatise, named Pantometria, diuided into three bookes, longimetria, planimetria, and stereometria, &c.," first pub-

lished in 1571, with a second edition in 1591, wherein the "composition of the instrument called Theodelitus" is represented as a "circle diuided in 360 grades or degrees, or a semi-circle parted in 180 portions"; or again, "the composition also of the Square and Planisphere or Circle named Theodelitus for measuring lengthes, breadths, and distances." It had a "double scale," an "index," "the sightes," and the circle was 2 feet in diameter, and "fastened in the top of some staffe." He does not state how the name was derived, and spells it "theodelitus" and "theodolitus" alternately. William Bourne ("Treasure for Travellers," 1578) named the same instrument "horizontall or flatte sphere," and not theodelitus; but when he speaks of the alidade he calls it only once *alideday*, but otherwise always *athelida*. After this de Morgan, who first discussed the derivation in the *Philosophical Magazine*, concluded that the "theodelited circle" of Digges, who, however, does not use that adjective, and "athelidated circle" of Bourne, were various corruptions of the Arabic word *al-ihāda* (a sort of rule), from which the word *alidade*, which carries the sight or telescope of a theodolite, is derived.

It has been suggested by various writers that theodolite is derived from the Greek roots *θεᾶ* (sight), *ὁδός* (the way), and *λίθος* (a stone), for the latter root *λίθος* (smooth) being

Reproduction of Digges' illustration of his "Theodelitus." From the *Zeitschrift für Vermessungswesen*.

substituted by others; also from *θεᾶω* (I see) and *δολῖχος* (long). Another suggested derivation is the English article "the" combined with the Arabic "*alidhada*."

In searching for a more satisfactory solution, the idea occurred to the writer that the word would naturally be compounded to represent the principal parts of the instrument, and when reading Prof. E. Hammer's latest and most interesting discussion in the *Zeitschrift für Vermessungswesen*, vol. xxxvii. (1908), pp. 81-91 and 113-25, he was impressed by one of the illustrations reproduced of Digges' "theodelitus" and description of it, with special mention of the words "sightes," "index," and "double scale." He would submit, therefore, that the true etymology is from the Greek words *θεᾶ*=a sight; *ὁδός*=any pointed instrument; *λίθος*=a circle or a fellow of a wheel. These Greek words appear to be those which would actually denote the three essential parts of the instrument, viz. the sight, the index arm, or alidade (Digges uses the word index, never alidade), which is represented as a pointed instrument, and the limb of graduated circle. The spaces on the circle appear like the

¹ *Philosophical Magazine*, vol. xxviii. (1846), note by de Morgan, pp. 287-9. *Poggendorff's Annalen*, vol. cxxxi. (1868), pp. 102, 349. *Zeitschrift für Vermessungswesen* (1880), p. 55; (1883), p. 321; (1908), pp. 81-91 and 113-25. *Vogler's Praktische Geometrie* (1884), p. 361. *Proc. Inst. C.E.*, vol. clxxiii. (1907-8), p. 330. *Preussische Jahrbücher*, note by Prof. Didolf, vol. cxvii. (1904), pp. 362-4.