LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Reflection of Röntgen Radiation.

FOLLOWING the investigations of Laue, Friedrich, and Knipping, we were led to study the transmission of a narrow pencil of X-rays through rock salt, a crystal of simple cubic form. The results are of interest, for they show in a striking way a strong reflection from the internal crystallographic planes upon which the pencil fell at nearly grazing incidence. The pencil so reflected is of such intensity that the short exposure required to produce well-marked effects on a photographic plate is insufficient to give more than a trace of the most intense of the other pencils of radiation emerging from the crystal. A small cleaved fragment was placed with one pair of faces horizontal Below this an X-ray tube was fixed to a stand capable of sliding in grooves along an arc of a vertical circle of which the centre was a point in the crystal and the plane was one of the three principal planes of the crystal. A narrow pencil of X-radiation could then be rotated in this plane approximately about the point of incidence on the crystal.

When the pencil was vertical it was, of course, perpendicular to one face, and parallel to the other two sets of mutually perpendicular principal planes in the crystal. A slight movement of the X-ray tube directed the pencil at nearly grazing incidence on one of the sets of vertical planes. The result was a well-marked spot on the photographic plate situated several centimetres above the crystal, on the same side of these crystallographic planes as the incident pencil. When the latter was made to rotate until it was incident on the other side of these planes, the emergent beam moved through the central direct image to the other side, being again on the same side of the crystallographic planes considered as the incident pencil. The angle turned through by the emerging beam was certainly within a very small possible error the same as that turned through by the incident pencil. We thus have very direct evidence of copious reflection near grazing incidence from cleavage planes within the crystal itself.

This suggested the probability of a similar reflection from the planes of cleavage of mica, and we proceeded to make a concave mirror of mica to test this. A letter from Mr. W. L. Bragg in NATURE of December 12, however, announces that this has just been accomplished. In our experiments with rock-salt the beam enters the crystal in a different manner, but the effect is undoubtedly similar. It is not a pure surface effect, but takes place in the body of the crystal. Whether all the photographic patterns obtainable by experiments like those of Laue, Friedrich, and Knipping are readily explained by reflection, as suggested by Mr. W. L. Bragg, our experiments do not yet permit us to say; but the results of observation of an isolated spot certainly can be accounted for by reflection from a large number of layers of atoms, parallel to one of the pairs of faces of the crystal.

Judging from recent experience we have had of the photographic action of X-rays, it appears probable that a beam reflected in such a way is of sufficient intensity to be detected and followed without any great difficulty by the ionisation method.

C. G. BARKLA.
G. H. MARTYN.

King's College, London December 14.

Shinobu Hirota.

SHINOBU HIROTA, who returns to Japan at the end of this month, by his doctor's advice, came with me to this country in 1895, and within a week of his arrival the seismograph which he brought with him from Japan was at work at Shide. To convince those who had doubts as to the possibility of recording in Britain earthquakes which had originated even so far away as their antipodes, a second instrument was installed at Carisbrooke Castle. To look after this Hirota had, wet or fine, a daily walk of four miles. The fact that these two instruments gave similar records and also that from a single record we could tell the distance at which a megaseism had originated naturally attracted some attention. Directly it was shown that certain earth disturbances had interrupted cables, Colonies desirous of knowing the cause of these sudden isolations from the rest of the world set up seismographs.

This was the commencement of the British Association cooperation of seismological stations, now sixty in number. To bring this into being Hirota played an active part. He knows personally many of the directors, and has given instruction to their officers. In practical seismometry he has made many innovations, some of which will perhaps be looked upon as "mere dodges," but they have rendered instruments more sensitive. His multiplying levers made of grass stems gathered from "bents" give pointers exactly one-third the weight of their equivalent in aluminium, and yet twice, if not three times, as stiff. It was by using these that we got at Bidston, where Hirota went to set up an instrument, the first records of rock deformation due to tidal load.

In the workshop he is a good all-round workman, in the observatory and office he has kept most careful records, could calculate a chordal distance, make a zenithal projection or an observation for time, while for photographic work he holds a gold medal from the Photographic Society of the Isle of Wight. Above all this, his sharp eyes would find on a seismogram two records where at other stations only one had been discovered. In view of the great attention and large sums which have now been spent, particularly in foreign countries, on the new seismological departure, I feel myself justified in giving recognition to an assistant pioneer in these new studies. Illness carries him back to his native country, where I trust he will have a speedy recovery. His work is embodied in annual seismological reports of the last seventeen years, and twenty-six circulars giving the records received from observatories cooperating with the British Association.

J. MILNE.

Shide, Newport, Isle of Wight.

The Self-testing of Dispersion Apparatus.

A SERIOUS inconvenience attaches to the standard method of testing a plane grating, echelon, or other dispersive apparatus, by crossing its dispersion with that of an auxiliary piece; for, unless the resolving power of the auxiliary dispersion is in some degree comparable with that of the piece to be tested, it is scarcely possible to identify ghosts which lie close to their primaries. When an extended research with crossed dispersions is in question, the case, in most laboratories, becomes even more difficult.

The difficulty, I think, may be removed by means of a simple and relatively inexpensive arrangement of two front-reflecting mirrors, so devised that the echelon (say) is crossed with its own dispersion. One of the mirror faces has one truly straight edge, at which the dihedral angle is 90° or less. This edge is in contact with the face of the second mirror, the