incidence greater than about 78°, and this is unfortunately a considerably larger angle than the probable polarising angle. Experiments with incidence in the neighbourhood of 45° should prove peculiarly decisive, for whereas ordinary light cannot as a rule be completely polarised by reflection, the reflection of X-rays, which occurs at planes of atoms, is independent of any contamination of the exposed crystal surface, and polarisation, once established, should prove complete for radiation reflected at the polarising angle. The selectively reflected X-rays seem to show the same effects as does the generally reflected beam. Selectively reflected radiation is always detectable after the second reflection, but this seems due to the selectively reflected radiation produced at the second reflector by the unpolarised portion of the beam generally reflected at the first reflector.

The application of a theory of polarisation to explain the above results is interestingly supported by the fact that in the case of two reflections by parallel reflectors, the proportion of X-rays reflected at the second reflector is invariably greater than the proportion of rays reflected at the first; that is, the ratio of reflected radiation to incident radiation at the second reflector is always greater than the same ratio at the first reflector. This might be expected if vibrations perpendicular to the plane of incidence are to be reflected to a greater extent than those in the plane of incidence. The proportion of such vibrations is larger in the beam incident on the second reflector than in the original beam, and a greater proportion of radiation would be reflected at the second reflector than could be at the first. For the case of parallel reflectors and incidence of a primary beam on the first at the polarising angle, the reflection at the second should be complete. E. JACOT.

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November 14.

Residual Ionisation in Gases.

FROM observations made by Simpson and Wright, the writer, and others, it is now known that the ionisation in air confined in airtight clean zinc vessels is about 8 or 9 ions per c.c. per second when the observations are made on land where the soil contains only such minute traces of radio-active substances as are found in ordinary clays or loams.

On the other hand, when the observations are made on the ocean or on the surface of large bodies of water, such as Lake Ontario, the ionisation in the same air confined in the manner indicated above drops to about 4 ions per c.c. per second. This reduction in the number of ions per c.c. per second has been shown to be due to the absorption of the earth's penetrating radiation by the water of the ocean and by that of the lakes.

On a recent voyage from England to Canada, I thought it would be interesting to see what the drop in the ionisation would be when the air in a zinc vessel was replaced by hydrogen. The observations were made on the ss. *Megantic*, a vessel of about 14,000 tons burden. On this boat the ionisation in air confined in a Wulf electrometer made of zinc was found to be 4·65 ions per c.c. per second, while in hydrogen it was 1·8 ions per c.c. per second. On reaching Toronto the experiment was repeated in a building which was free from any radio-active impurity, and in this case the ionisation in air was found to be 8·8 ions per c.c. per second, while in hydrogen it was 2·0 ions per c.c. per second.

The ionisation of the air on land was therefore 4·15 ions per c.c. per second more than it was upon the steamship, while the ionisation in hydrogen on the land was only 0·2 ion per c.c. per second more than on the sea. From this it follows that the ionisation produced in air by the penetrating radiation at the surface of the earth at Toronto was about twenty times as much as that produced by the same radiation in hydrogen.

Since the residual ionisation in hydrogen on the ocean was nearly 40 per cent. of that in air, it is evident that the residual ionisation in these two gases could not have been due to a radiation of the type of the earth's penetrating rays. Experiments should therefore be directed to determining whether this residual effect in gases is due to the action of an easily absorbed radiation from the walls of the vessel in which the gases are confined, or whether it has its origin in a disruption of the molecules occurring either spontaneously or through the agency of collisions.

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November 13.

The Nile Flood of 1913.

FOR some years past the Meteorological Office of the Egyptian Survey Department, under the direction of Mr. J. I. Craig, has carried out researches on the question of the possibility of forecasting the Nile flood, and he has put forward the theory that the rain which falls in Abyssinia comes from the South Atlantic (see "England, Abyssinia, the South Atlantic: a Meteorological Triangle," Quarterly Journal Royal Meteorological Society, October).

There is much evidence to support this, and correlations have been established between the flood, and pressure and wind velocity at St. Helena, and pressure in South America. So far the best prediction which can be based on these correlations is for the mean height of the Nile at Halfa, between July 16 and August 15, that is, in normal years for the middle of the rising stage. The probable error of a prediction based on this is ±0·33 metre, whereas a prediction which assumes that the river will be normal in any given year would have a probable error of ±0·55 metre. This result is sufficiently encouraging to make further work promising, and the writer is pursuing the investigation.

The flood of this year has been the lowest of which there is authentic and complete record. Records of the maximum and minimum of the flood as recorded on the Roda Nilometer (Cairo) go back to very early times, but naturally the early ones are less trustworthy than those of more recent date. The following figures, taken from "Egyptian Irrigation," by Sir William Willcocks and Mr. J. I. Craig, give the lowest recorded floods in recent times:—

Period	Lowest maximum recorded on Roda Nilometer Metres	No. of years of period recorded
1701–1725 ...	17·35 ...	18
1726–1750 ...	18·58 ...	24
1751–1775 ...	18·08 ...	25
1776–1800 ...	15·49 (1) ...	
1801–1825 ...	13·14 (2) ...	3
1826–1850 ...	18·15 ...	25
1851–1875 ...	18·30 ...	25
1876–1900 ...	17·65 ...	25
1901–1913 ...	17·17 (1913) ...	13

(2) Is almost certainly an error of 10 pics. (the divisions on the gauge), and it seems very probable that (1) is also an error, as at the present day in the low stage the river is artificially kept at a level of about 15 metres by the Delta Barrage and the Aswan Dam, and the average level in the low stage before the Barrage became effective was about 13 metres.

During the last twenty-four years calculations of the discharge at Halfa have been made, and as the