XIII. "Note on a Comparison of the Diurnal Ranges of Magnetic Declination at Toronto and Kew." By BALFOUR STEWART, LL.D., F.R.S., and WILLIAM DODGSON. Received June 9, 1881.

Through the kindness of the Science and Art Department, South Kensington, and of Mr. Carpmael, Director of the Toronto Observatory, we have received daily values (excluding Sundays) of the diurnal range of magnetic declination at Toronto. These observations extend from 1856 to 1879 inclusive, thus forming a series of twenty-four years. Each number is the difference in scale divisions of the declinometer between the greatest eastern and greatest western deflection of the declination magnet on each day, as observed at the hours 6 A.M., 8 A.M., 2 P.M., 4 P.M., 10 P.M., and midnight, of Toronto mean time, one scale division of the instrument being equal to 0′·72 nearly. It is probable that such differences represent very nearly the true diurnal range.

Disturbances appear to be violent at Toronto, and we have rejected a few of the most disturbed observations, embracing those which denote ranges above forty scale divisions, or 28′·8. In all 107 observations were thus rejected in the series of twenty-four years. Although this rejection has been made, it must not be supposed that the remainder are entirely undisturbed, but are only freed from the excessive influence of a few violent disturbances. We have reduced in the meantime the sixteen years extending from 1858 to 1873, in order to compare them with a similar series of the Kew diurnal declination ranges, including disturbances.

The method of reduction has been precisely that adopted for the Kew series, and already described by us (see "Proc. Roy. Soc.," No. 20, 1879, p. 313).

Our object was to see whether there is any difference in phase between the various Toronto and Kew inequalties, and for this purpose we have adopted precisely the method formerly pursued by us when comparing together the declination ranges at Kew and Prague (see "Proc. Roy. Soc.," vol. 29, p. 316).

We have thus obtained the following result:—

Table 1.—Algebraic sum of Toronto and Kew Magnetic Inequalities.

Toronto and Kew	(Toronto 1 division to left)			=154514.
,,	(together)			=161094.
,,	(Toronto 1 division to right)			=165016.
,,	,,	2	,,	=165418.
,,	,,	3	,,	=161404.
,,	,,	4	,,	=154320.

It would appear from this table that the phases of the various magnetic inequalities occur at Toronto nearly two days (more strictly 1·6 days) before the advent of the corresponding phases at Kew.

The result already obtained for Kew and Prague shows that the phases of magnetic inequalities occur at Kew nearly one day (more strictly 0·7 day) before the advent of the corresponding phases at Prague. Thus the two results agree together in representing a progress of magnetic weather from west to east, and agree also with a result obtained by Balfour Stewart and Morisabro Hiraoka (see "Proc. Roy. Soc.," vol. 28, p. 288), showing that magnetic weather changes occur at Trevandrum, in India, 9·7 days later than at Kew.

It ought, however, to be borne in mind that in the intercomparison of Toronto, Kew, and Prague, the observations include disturbances, while in the intercomparison of Kew and Trevandrum the undisturbed observations at Kew are compared with the whole body of observations at Trevandrum, this latter being a tropical station in which the effect of disturbance is extremely small.

XIV. "On the Absorption of Gases by Solids." By J. B. Hannay, F.R.S.E., F.C.S. Communicated by Professor G. G. Stokes, D.C.L., &c., Sec. R.S. Received June 4, 1881.

During the progress of the investigations which I have from time to time had the honour of bringing under the notice of the Royal Society, I have again and again noticed the apparent disappearance of gases inclosed in vessels of various materials when the disappearance could not be accounted for upon the assumption of ordinary leakage. After a careful examination of the subject I found that the solids absorbed or dissolved the gases, giving rise to a striking example of the fixation of a gas in a solid without chemical action.

In carrying out that most troublesome investigation, the crystalline separation of carbon from its compounds, the tubes used for experiment have been in nine cases out of ten found to be empty on opening them, and in most cases a careful testing by hydraulic press showed no leakage. The gases seemed to go through the solid iron, although it was 2 inches thick. A series of experiments with various linings were tried. The tube was electro-plated with copper, silver, and gold, but with no greater success. Siliceous linings were tried—fusible enamels and glass—but still the tubes refused to hold the contents. Out of thirty-four experiments made since my last results were published, only four contained any liquid or condensed gaseous matter after the furnacing. I became convinced that the solid matter at the very high pressure and temperature used must be pervious to gases.