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.

This I find to be the case, and to a very remarkable extent. I am still investigating this matter, but as I have so much on hand it may be some time before I can finish the work, so I wish to place on record the results so far as I have proceeded. I find that glass, when at a temperature of about 200°, absorbs a large quantity of gas when the latter is under a pressure of 200 atmospheres. Oxygen and carbon dioxide have been used, and have been found to be largely absorbed, and on cooling the glass under pressure the gas is retained permanently fixed. So much is absorbed that, on quickly raising the temperature to the softening temperature of the glass, the sudden escape of gas drives the glass into foam. On slowly raising the temperature and retaining it at 300°, most of the absorbed gas is given off without any visible action.

The frothing up of the glass by the outrush of gas is very striking. Other silicates, and also borates and phosphates, absorb gas, especially carbon dioxide, under great pressure. Metals absorb hydrogen and some of its compounds with carbon. As the treatment of quantities of matter sufficient for analysis at these high pressures and temperatures is a matter of great difficulty, the majority of experiments being failures, the work proceeds but slowly; but I hope during the summer and autumn to be able to elucidate the subject quantitatively, when I shall detail the results to the Society.

XV. "On the States of Matter." 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.

The conception which had been held from the earliest times that the three recognised states of matter were clearly separated from each other received a rude blow from the interpretation put upon the work of Andrews, that the liquid and gaseous states were really continuous, and that the two states could only be classified under one head—the fluid state. Andrews demonstrated that by placing a liquid under a pressure greater than the critical, and then raising the temperature, the liquid might be made to pass to an undoubtedly gaseous state without any sudden change having been visible. Thus the continuity of the liquid and gaseous states seemed established. I say seemed, because I have shown in former papers that under any pressure the fluid passes at a given temperature from a state where it possesses cohesion, capillarity, or surface tension—the distinguishing property of liquid, which prevents it freely mixing with a true gas—to a state where it possesses no cohesion, capillarity, nor surface tension, and where it mixes freely with any gas—in fact, to the gaseous state; and this change takes place at a fixed temperature independent of pressure.