the agreement, as he says, far beyond his hopes. They show, he says, that the Theory comes near to the Truth.

### *Correction of Ships' Compasses.*

The magnetic needle had become of importance when it was found that it always pointed to the North. Since that time the history of magnetism has had its events reflected in the history of navigation. The change of the declination arising from a change of place terrified the companions of Columbus. The determination of the laws of this change was the object of the voyage of Halley; and has been pursued with the utmost energy in the Arctic and Antarctic regions by navigators up to the present time. Probably the dependence of the magnetic declination upon place is now known well enough for the purposes of navigation. But a new source of difficulty has in the meantime come into view; the effect of the iron in the ship upon the Compass. And this has gone on increasing as guns, cables, stays, knees, have been made of iron; then steam-engines with funnels, wheels, and screws, have been added; and finally the whole ship has been made of iron. How can the compass be trusted in such cases?

I have already said in the history that Mr. Barlow proposed to correct the error of the compass by placing near to the compass an iron plate, which from its proximity to the compass might counterbalance magnetically the whole effect of the ship's iron upon the compass. This correction was not effectual, because the magnetic forces of the plate and of the ship do not change their direction and value according to the same law, with the change of position. I have further stated that Mr. Airy devised other means of correcting the error. I may add a few words on the subject; for the subject has been further examined by Mr. Airy[8] and by others.

It appears, by mathematical reasoning, that the magnetic effect of the iron in a ship may be regarded as producing two kinds of deviation which are added together;—a "polar-magnet deviation," which changes from positive to negative as the direction of the ship's keel, in a horizontal revolution, passes from semicircle to semicircle; and a "quadrantal deviation," which changes from positive to negative as the keel turns from quadrant to quadrant. The latter deviation may be remedied completely by a mass of unmagnetized iron placed on a level

[8] *Phil. Trans.* 1856.