constitution of the great magnet, it is almost a deſperate task to ascertain by computation what will be the position of the needle. Halley ſeems to have deſpaired ; for he was both an elegant and a most expert mathematician, and it would have cost *him* little trouble to aſcertain the places of two poles only, and the direction which theſe would have given to the needle. But to say what would be its poſition when acted on by four poles, it was necessary to know the law by which the magnetic action varied by a variation of distance ; and even when this is known, the computation would have been exceedingly difficult.

In order to account for the change of variation, Dr Halley ſupposes this internal magnet not to adhere to the external shell which we inhabit, but to form a nucleus or kernel detached from it on all ſides, and to be ſo poised as to revolve freely round an axis, of which he hoped to diſcover the poſition by obſervation of the compaſs. The philoſopher will find nothing in this ingenious hypothesis inconsistent with our knowledge of nature. Dr Halley imagined that the nucleus revolved from east to west round the same axis with the earth. Thus the poles of the magnet would change their poſitions relatively to the earth’s ſurface, and this would change the direction of the compaſs needle.

The great Euler, whose delight it was always to engage in the most difficult mathematical researches and computa­tions, undertook to aſcertain the position of the needle in every part of the earth. His dissertation on this ſubject is to be seen in the 13th volume of the Memoirs of the Royal Academy of Berlin, and is exceedingly beautiful, abounding in thoſe analytical *tours d'adresse* in which he ſurpassed all the world. He has reduced the computation to a wonder­ful simplicity.

He found, however, that four poles would engage him in an analysis which would be excessively intricate, and has contented himſelf with computing for two only ; obſerving that this ſupposition agrees ſo well with obſervation, that it is highly probable that this is the real constitution of the terrestrial magnet, and that the coincidence would have been perfect if he had hit on the due poſitions of the two poles. He places one of them in lat. 76⁰ north, and long. 96⁰ west from Teneriffe. The ſouth pole is placed in lat. 58⁰ ſouth, and long. 158⁰ west from Teneriffe. Theſe are their situations for 1757. —Mr Euler has annexed to his dissertation a chart of Halleyan curves ſuited to theſe aſſumptions, and fitted to the year 1757.

It must be acknowledged, that the *general* courſe of the variations according to this theory greatly resembles the real state of things ; and we cannot but own ourselves highly indebted to this great mathematician for having made ſo fine a first attempt. He has improved it very considerably in another dissertation in the 22d volume of theſe memoirs. But there are still ſuch great differences, that the theory is of no ſervice to the navigator, and it only ſerves as an ex­cellent model for a farther proſecution of the subject. Since that time another large variation chart has been publiſhed, fitted to a late period ; but the public has not ſufficient information of the authorities or obſervations on which it is founded.

The great object in all theſe charts is to facilitate the diſcovery of a ſhip s longitude at ſea. For the lines of va­riation being drawn on the chart, and the variation and the latitude being obſerved at ſea, we have only to look on the chart for the intersection of the parallel of obſerved latitude and the Halleyan curve of obſerved variation. This inter- ſection must be the place of the ſhip. This being the purpoſe, the Halleyan lines are of great ſervice ; but they do not give us a ready conception of the direction of the needle. We have always to *imagine* a line drawn through the point, cutting the meridian m the angle corresponding to the Halleyan line. We ſhould learn the general magnetic affections of the globe much better if a number of magnetic meridians were drawn. These are the interſections of the earth’s ſurface with planes passing through the magnetical axis, cutting one another in angles of 5⁰ or 10⁰. This would both ihow us the places of the magnetic poles much more clearly, and would, in every place, ſhow us at once the direction of the needle. In all thoſe places where theſe magne­tical curves touch the meridians, there is no variation ; and the variation in every other place is the angle contained be­tween theſe magnetical meridians and the true ones.

The program of a work of this kind has been publiſhed by a Mr Churchman, who appears to have engaged in the investigation wich great zeal and considerable opportunities. He had been employed in some operations connected with ſurveys of the back settlements in North America. It is pretty certain that the north magnetic pole (or point, as Mr Churchman chooſes to call it) is not far removed from the stations given it by Halley and Euler ; and there ſeems no doubt but that in the countries between Hudſon’s Bay and the western coasts of North America the needle will have every position with reſpect to the terrestrial meridian, ſo that the north end of a compaſs needle will even point due ſouth in ſeveral places. Mr Churchman has ſolicited assistance from all quarters, to enable him to traverſe the whole of that inhoſpitable country with the compaſs in his hand. It were greatly to be wiſhed that our gracious ſovereign, who has always shown ſuch a love for the promotion of nautical ſcience, and who has ſo munificently contributed to it, al­ready enriching the world with the most valuable discoveries, and thus laying posterity under unſpeakable obligations ; it were greatly to be wished that he would put this almost finiſhing stroke to the noble work, and enable Mr Church­man, or ſome fitter perſon, if ſuch can be found, to prosecute this most interesting inquiry. Almost every thing that can be desired would be obtained by a few *well-chosen* obſervations made in thoſe regions. It would be of immenſe advantage to have the *dips* aſcertained with great precision. Theſe would enable us to judge at what depth under the ſurface the pole is situated ; for the well informed mechani­cian, who will study ſeriously what we have ſaid about the magnetical curves, will see that a compaſs needle, when compared with the great terrestrial magnet, is but as a particle of iron-filings compared to a very large artificial magnet. Therefore, from the position of the dipping needle, we may infer the place of the pole, if the law of magnetic action be given ; and this law may be found by means of other experiments which we could point out.

Mr Churchman has adopted the opinion of only two poles. According to him, the north pole lies (in 1800) in Lat. 58⁰ N. and Long. 134⁰ west from Greenwich, very near Cape Fair-weather; and the ſouth pole lies in Lat. 58⁰ S. and Lon. 165⁰ E. from Greenwich. He also imagines that the north pole has moved to the eastward, on a paral­lel of latitude, about 65 since the beginning of last century (from 1600), and concludes that it makes a revolution in 1096 years. The southern pole has moved leſs, and com­pletes its revolution in 2289 years. This motion he aſcribes to ſome influences which he calls *magnetic tides,* and which he ſeems to consider as celestial. This he infers from the changes of variation. He announces a physical theory on this ſubject, which, he says, enables him to compute the va­riation with precision for any time past or to come ; and he even gives the proceſs of trigono metrical computation illustrated by examples. But as this publication (entitled *The Magnetic Atlas,* publiſhed for the Author, by Darton and Harvey, *1*794) is only a program, he expresses himſelf ob-