

In truth, at the moment when this was uttered, the new Planet had already been seen by Professor Challis; for, as we have said, he had seen it in the early part of August. He had included it in the net which he had cast among the stars for this very purpose; but employing a slow and cautious process, he had deferred for a time that examination of his capture which would have enabled him to detect the object sought. As soon as he received M. Le Verrier's paper of August 31 on September 29, he was so much impressed with the sagacity and clearness of the limitations of the field of observation there laid down, that he instantly changed his plan of observation, and noted the planet, as an object having a visible disk, on the evening of the same day.

In this manner the theory of gravitation predicted and produced the discovery. Thus to predict unknown facts found afterwards to be true, is, as I have said, a confirmation of a theory which in impressiveness and value goes beyond any explanation of known facts. It is a confirmation which has only occurred a few times in the history of science; and in the case only of the most refined and complete theories, such as those of Astronomy and Optics. The mathematical skill which was requisite in order to arrive at such a discovery, may in some measure be judged of by the account which we have had to give of the previous mathematical progress of the theory of gravitation. It there appeared that the lives of many of the most acute, clear-sighted, and laborious of mankind, had been employed for generations in solving the problem, Given the planetary bodies, to find their mutual perturbations: but here we have the inverse problem—Given the perturbations, to find the planets.<sup>3</sup>

### *The Minor Planets.*

The discovery of the Minor Planets which revolve between the orbits of Mars and Jupiter was not a consequence or confirmation of the Newtonian theory. That theory gives no reason for the distance of

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<sup>3</sup> This may be called the *inverse* problem with reference to the older and more familiar problem; but we may remark that the usual phraseology of the Problem of Central Forces differs from this analogy. In Newton's *Principia*, the earlier Sections, in which the motion is given to find the force, are spoken of as containing the *Direct* Problem of Central Forces: the Eighth Section of the First Book, where the Force is given to find the orbit, is spoken of as containing the *Inverse* Problem of Central Forces.