

I am aware that Lalande, more than fifty years ago, on two nights—which, if he had pursued the object then first discovered, would have been well distinguished from the rest of the year, and would have added new glory to his own name—did observe what is now fully ascertained to have been the planet Neptune; but though Uranus had just been added to those bright orbs, which, to mortal eyes, for more than 2,000 years have been known to circle our sun, Lalande was observing before Piazzi, Olbers, and Harding had added Ceres, Pallas, Juno and Vesta to that number, and before by those discoveries it was proved, not only that the planets round the sun had passed the mystic number of seven—since Herschel had confuted that ancient belief—but that others might also remain to reward the patient labours of other observers. He therefore distrusted his own eyes; and preferred to believe that he had been mistaken, rather than that the existence and force of a new planet had been reserved for the discovery of this latter age. What his eyes saw, but what his judgment failed to discriminate and apply, has since become a recognized fact in science.

I will not presume to measure the claims of the two illustrious names of Leverrier and Adams: of him, who, in midnight workings and watchings, discovered the truth in our own country, and of the hardly happier philosopher who was permitted and enabled to be the first, after equal workings and watchings, to proclaim the great reality which his science had prepared and assured him to expect. I will trust myself with only two observations: the one my earnest hope that the rivalry not merely of the illustrious Leverrier, and of my illustrious countryman Adams, but of the two great nations which they represent, France and England, respectively, may always be confined to pursuits in which victory is without woe, and to studies which enlarge and elevate the mind, and which, if rightly directed, may produce alike glory to God and good to mankind: and the other, my equal hope, that for those (some of whom I trust may now hear me) who employ the same scientific training and the same laborious industry which have marked the researches of Leverrier and Adams, there may still remain similar triumphs in the yet unpenetrated regions of space; and that—unlike the greater son of a great father—they may not have to mourn that there are no more worlds to be conquered.

It is a remarkable fact that the seeing of the planet Neptune was effected as suddenly at Berlin by means of one of the star-maps which has proceeded from an association of astronomers, chiefly Germans; such maps forming in themselves a sufficient illustration of the value of such Associations as our own, by which the labor and the expense—too great, perhaps, for any one individual—are supplied by the combined exertions of many kindred followers of science.

It is another result of the circulation of these star-maps, that a new visitor, a comet, can hardly be within the range of a telescope for a few hours without his presence being discovered and announced through Europe. Those comets which have been of larger apparent dimensions, or which have continued longer within view, have in consequence, for more than 2,000 years been observed with more or less accuracy; their orbits have been calculated; and the return of some has been determined with a precision which in past ages exercised the wonder of nations;—but now, improved maps of the heavens, and improved instruments, by which the strangers who pass along those heavens are observed, carry knowledge where conjecture lately dared not to penetrate. It is not that more comets exist, as has sometimes been said, but more are observed.

An Englishman—a subject of this United Kingdom—cannot refer to the enlarged means of astronomical observation enjoyed by the present age without some allusion to the noble Earl, Lord Rosse, one of the Vice-Presidents of this day, who, himself educated amongst us here in Oxford, has devoted large means and untiring labour to the completion of the most wonderful telescope which Science, Art and wealth have ever yet combined to perfect; and which the Dean of Ely—a man worthy to praise the work—pronounced to be a rare combination of mechanical, chemical and mathematical skill and knowledge. Its actual operations have been suspended by a cause not less honourable to Lord Rosse in another character than the conception and early progress of his great instrument were to him as a man of science. They have been retarded, so far as he himself is concerned, by the more immediate, and, I will say, higher duties which, as a magistrate, as a landowner, and as a Christian gentleman, he owed and has been paying, to his neighbours, his tenantry, and his country, during the late awful visitation which has afflicted Ireland. Yet perhaps my noble friend will permit me to say, that while we not only do not blame him—we even praise him cordially for having devoted his time, his mind, and his wealth to those claims which could not be postponed, since they affected the lives of those who in God's providence surrounded him—there were, and there are, others, two, at least, in his own country, and one his most illustrious friend, Dr. Robinson (but I speak without any communication on the subject from that great observer and greater philosopher) who might have carried on the series of observations which this wonderful telescope alone can effect, and might thus have secured for his own division of the empire the discovery of the planet Neptune.

The Catalogues of Lacaille and of the *Histoire Celeste* are now before the world; and with the Catalogue of our Association constitute a series of most important gifts conferred on astronomy. I have already said that I will not presume to measure the relative merits of two eminent individuals;—it is as little within my power to measure the value of such gifts to science. That value can be duly

appreciated by none but the great masters of this, the greatest of the sciences: but I may be permitted to add, that here, also, come into beneficial action the powers and the uses of such an association; which, rising above the mere calculations of pecuniary profit, provides for the few who only are capable of extracting the just benefit from such works those materials of advancing knowledge which are beyond the reach of individuals.

The Astronomer Royal has done me the honor and the kindness, by a paper which I have just received from him, to make me the vehicle of communicating his wisdom to you on a most important and interesting discovery of the past year.

"In the lunar theory a very important step has been made in the course of the past year. When, near the beginning of the present century, a considerable number of the Greenwich lunar observations were reduced by Burg for the purpose of obtaining elements for the construction of his Lunar Tables, and generally for the comparison of the moon's observed place with Laplace's theory, it was found impossible to reconcile the theoretical with the observed places except by the assumption that some slowly varying error affected the epoch of the moon's mean longitude. From the nature of the process by which the errors of the elements are found, the conclusion upon the existence of this peculiar error is less subject to doubt than that upon any other error. So certain did it appear, that Laplace devoted to it one entire chapter in the *Mécanique Céleste*, with the title "On an inequality of long period by which the moon's mean motion appears to be affected." Guided by the general analogy of terms producing inequalities of long period, he suggested as its probable cause an inequality whose argument depends upon a complicated combination of the longitude of the earth's perihelion, the longitude of the moon's perigee, the longitude of the moon's node, and the moon's angular distance from the sun. But he made no attempt to calculate its theoretical effect. He also suggested an inequality depending on a possible difference in the northern and southern hemispheres of the earth. Many years elapsed before these suggested theoretical inequalities were carefully examined by physical astronomers. At length the introduction of new methods enabled Poisson and Lubbock successfully to enter upon the investigation of the theoretical values; and they proved that inequalities depending on the arguments suggested by Laplace could not have sensible values. The theory was now left in greater doubt than ever; and suspicion fell even on the accuracy of the reductions of the observations.

A few years since, as is well known to members of the British Association, the British Government, at the representation of the Association, sanctioned the complete reduction, on a uniform plan, of all the observations of the moon made at the Royal Observatory of Greenwich since the year 1750: and the immediate superintendence of this work was undertaken by the Astronomer Royal. The reductions are now printing in all necessary detail; and the press-work is at this time very far advanced. In the last summer the corrections of the elements of the moon's orbit were generally obtained; and the errors of epoch in particular at different times were found with great accuracy. These results confirmed those of Burg, and extended the law of the inequality to a much later time. In this state they were exhibited by the Astronomer Royal to Professor Hansen of Gotha, who was known to be engaged in the Lunar Theory. Professor Hansen immediately undertook a search for their theoretical causes. His perfect knowledge of the state of the existing theories enabled him at once to single out the class of disturbances produced by the action of the planets as that in which the explanation of this inequality would probably be found. In the course of a systematic search, many inequalities of long period were found; but none of sensible magnitude. At length two were found, both produced by the disturbing force of Venus, of a magnitude entirely unexpected. One depends upon the circumstance that eighteen times the mean anomaly of Venus diminished by sixteen times the mean anomaly of the Earth increases at very nearly the same rate as the mean anomaly of the Moon: its co-efficient is 27" and its period 273 years. The other depends upon the circumstance, that eight times the mean anomaly of Venus increases at very nearly the same rate as thirteen times the mean anomaly of the Earth: its co-efficient is 25" and its period 239 years. The combination of these two explains almost perfectly the error of epoch, which had so long been a subject of difficulty. The discovery of these two inequalities, whether we regard the peculiarity of their laws, the labours expended upon the investigations, or the perfect success of their results, must be regarded as the most important step made in physical astronomy for many years."

The doctrine of the influence of the moon and of the sun on the tides was no sooner established than it became eminently probable that an influence exerted so strongly upon a fluid so heavy as water could not but have the lighter and all but imponderable fluid of air under its grasp. I speak not of the influence attributed to the moon in the popular language and belief of nations ancient and modern,—of Western Europe and of Central Asia, in respect to disease; but of the direct and measurable influence of the moon and of the sun in respect to the air. It is now clear, as the result of the observations at Saint Helena by my friend Colonel Sabine, that, as on the waters, so on the atmosphere there is a corresponding influence exerted by the same cause. There are tides in the air as in the sea; the extent is of course determinable only by the most careful observations with the most delicate instruments; since the minuteness of the effect, both in itself and in comparison with the disturbances which are occasioned in the equilibrium of the