

centre, where they are sufficiently condensed to produce the appearance of a nucleus. These we are told are the most magnificent objects that can be seen in the heavens.

7. *Nebulæ*.—These, it is thought, may be resolved into the three last-mentioned species, only removed to such a distance that they can only be seen by means of the most powerful telescopes.

8. *Stars with burrs, stellar Nebulæ*.—These are thought to be clusters of stars, at great distances, the light of which is gathered so nearly into one point, as to leave but just enough of it visible to produce the appearance of burrs.

9. *Milky nebulosities*.—These phenomena are probably of two different kinds, one of them being deceptions; namely, such as arise from extensive regions of closely connected clustering stars contiguous to each other, like those that compose our milky way: the other, on the contrary, being real, and possibly at no very great distance from us. The milky nebulosity of Orion, discovered by Huygens, is given as an instance of this singular appearance.

10. *Nebulous stars*.—Whether these be the effect of the atmospheres of certain stars remains yet to be determined; and indeed every thing respecting the nature of these appearances is still involved in much doubt and obscurity.

11. *Planetary Nebulæ*; and 12. *Planetary Nebulæ with centres*.—These also, though objects manifestly distinct from the former ones, are as yet so imperfectly known, as to baffle all reasoning concerning their nature and habits; and Dr. Herschel contents himself for the present with merely inserting the few he has observed in his catalogue.

Here follows the copious catalogue of Nebulæ, &c., which being a continuation of two preceding papers of the like nature, and arranged in the same manner, requires no further explanation.

The Bakerian Lecture. Observations on the Quantity of horizontal Refraction; with a Method of measuring the Dip at Sea. By William Hyde Wollaston, M.D. F.R.S. Read November 11, 1802. [Phil. Trans. 1803, p. 1.]

In a communication on this subject, published in the volume of the Philosophical Transactions for the year 1800, Dr. Wollaston accounted for various singular phenomena of horizontal refraction by certain gradual changes in the density of the refracting medium. Having since perused what M. Monge has published in the *Mémoires sur l'Égypte*, concerning the appearance known to the French by the name of *Mirage*, where it is ascribed to permanent rarefied strata of air near the surface of the earth; our author, having reconsidered the subject, and finding that the facts related by the French philosopher accord entirely with his own theory, declares here that he still adheres to his former opinion, and assigns his reasons for not departing from it.

The chief of these reasons is, that the definite reflecting surface,

which M. Monge supposes to take place between two strata of air of different density, is by no means consistent with that continued ascent of rarefied air which he himself admits; and that the explanation founded on this hypothesis will not apply to other cases, which may all be satisfactorily accounted for, upon the supposition of a gradual change of density, and successive curvature of the rays of light by refraction.

The subject being of far greater importance than may at first sight appear, since the variations in the dip of the apparent horizon, on which all observations of altitude at sea necessarily depend, must be influenced by this variable refraction, our author has been vigilant in availing himself of every incident that might serve to throw some light on the subject: among these, the first that occurred was an appearance he saw on the river Thames; when being seated in a boat, with his eye about half a yard above the surface of the water, he perceived the oars of barges at some distance, bending inwards, the point of curvature or angle taking place at a small height above the sensible horizon.

He now recollected that the warmth of the summer having been very considerable, the temperature the water had acquired, and still retained when the atmosphere had become cooler, must occasion a rarefaction of the stratum of air above its surface greater than those at higher elevations.

This led him to a series of further observations, which he has collected in a table, from which we learn that, taking in likewise the hygrometrical changes in the atmosphere, the depression of the horizon is greater the higher the temperature of the water is above that of the air; but that this depression is materially diminished by the increasing dryness of the air.

That these refractions (which in the above-mentioned observations were by no means at all times consistent,) must be affected by the vicinity of land influencing the temperature of the air, will be easily admitted; and hence the observations at sea may, it is thought, afford some more accurate conclusions, though the quantity of depression may not be so great. Thus much however is evident, that the error in nautical observations, arising from a supposition that the horizon is invariably according to the height of the observer, stands greatly in need of correction.

How to apply this correction is the object of the close of this paper. This consists in measuring, by a back observation, the whole vertical angle between any two opposite points of the horizon, either before or after taking an altitude, and calculating half the excess of this angle above 180° , which will of course be the dip required.

A few cautions are lastly given for correcting some inaccuracies in the instruments, especially the index error in the back observations, which it is owned had been some years since suggested by Mr. Ludlam.