THURSDAY, APRIL 14, 1870

THE TOTAL SOLAR ECLIPSE OF DECEMBER NEXT

ON Friday last, Mr. Lassell, the president, brought before the Royal Astronomical Society the subject of the total solar eclipse of December next, with a view to eliciting information as to the steps necessary for observing it. A most interesting discussion ensued, in which the Astronomer Royal, the president, Messrs. De la Rue, Stone, and Huggins, Admiral Ommaney, Colonel Strange, and Lieutenant Browne, R.A., took part. The line of totality passes near the following places :—Odemira, in Portugal, Cadiz, Estepona (about twenty miles north of Gibraltar), Oran, on the Algerine coast, Syracuse, and the region including Mount Etna in Sicily.

The duration of totality will be a little over two minutes of time. It is proposed that an endeavour shall be made to equip two expeditions to observe the phenomena of the eclipse at two of these points, in order that, should adverse weather occur at one station, results may be, perhaps, obtained at the other. It is thought probable that the station of Oran, in Algeria, will be occupied by a French party of astronomers. The choice for English observers seems to be between Cadiz, Gibraltar, and Syracuse. Both Admiral Ommaney and Lieut. Browne, R.A., spoke from personal experience favourably of the climate of Gibraltar at that time of the year. The speakers were unanimous in considering that both parties ought to be equipped for the following main objects:—(1) Photography; (2) Spectrometry; (3) Polarisation. Other objects of subsidiary importance, as Photometry and Meteorology, would also receive due attention. An approximate estimate of personal and instrumental force gives from 20 to 25 skilled observers, and about 10 telescopes of from 4 to 6 inches aperture, as the complement necessary for *each* of the two expeditions.

The first step which the Council propose to take is to invite, by circular and other means, those prepared to volunteer for this service to send in their names at once, specifying the particular class of observation which the observer desires to be engaged in. The number of actually available telescopes and instruments will also be ascertained.

When this preliminary information has been acquired, the Council of the Royal Astronomical Society, which has resolved itself into a committee for the purpose, will then consider whether they should apply to Government for such assistance as may enable them to utilise, with the utmost advantage, their own resources. Pending the collection of this information, it would be premature to attempt any estimate of the public assistance which may be required to guarantee the success of this enterprise. But it is not too early to lay before our readers some idea of its character and importance.

The systematic examination of the solar surface is emphatically a modern study, which has, even during the last twelve months, advanced with enormous strides. Until recently these researches were limited to the ocular inspection and photographic representation of features rendered visible at ordinary times by our improved telescopic power, and to similar modes of examining certain other features developed during eclipses. Subsequently, with the wonderful aid afforded by the spectroscope, a new class of phenomena was brought under examination, but only momentarily, on the rare occasions of total solar eclipses. Only last year M. Janssen and Mr. Lockyer, labouring independently, showed that many of the spectroscopic observations, for securing which an eclipse had been believed to be indispensable, could be made without the aid of that phenomenon,—a discovery second, in dignity and value, to none that this age has achieved. But these very methods have opened out inquiries and doubts which again require for their solution the peculiar circumstances attending total obscuration of the sun's disc.

For instance, the corona which has been seen at times to extend to a distance beyond the sun greater even than the sun's diameter, has been very generally stated to indicate a solar atmosphere, a conclusion not entirely borne out, however, by the spectroscopic method of investigation; and Dr. Frankland and Mr. Lockyer have stated their opinion that the *whole* of the corona can hardly be solar—this opinion being based partly on their approximate determination of the pressure in these regions. This question was manfully attacked during the eclipse observed last year in America, but the results, which will be found most carefully detailed in the report printed by the American Government, were not conclusive.

Again, it has been shown that the solar chromosphere is not entirely seen by the new method of observation; away from the sun its light is ordinarily so feeble that it cannot be detected through our brighter atmosphere, but during eclipses it is seen; and in this matter the American astronomers did admirable work, which, however, requires strengthening, for many still hold that the radiance depicted on the photographic plates immediately round the moon in the photographs, is not the chromosphere, as stated by Dr. Gould and others, although there are very many arguments which can be brought forward in favour of their idea that it is that envelope. Other points might easily be brought forward to show the extreme and, in fact, special importance of eclipse observations at the present time.

If researches such as these yielded no fruits beyond the satisfaction of our craving desire to know more of the structure and constitution of the sun, they would still be prosecuted with ardour. But the knowledge they are calculated to advance has a much wider range and a more tangible character than the gratification of philosophical curiosity. Sabine, Lamont, and Wolf many years ago detected the contemporaneity of magnetic disturbances and the maximum outbreak of spots on the sun's surface. More recently De la Rue, Stewart, and Loewy have established a relation between the sun spot maxima and the configuration of the planets Venus and Jupiter. Systematic observations have been carried on at the Kew Observatory continuously for nine years for the express purpose of throwing light on the apparent connection of the sun spots with magnetic and planetary phenomena. During this period upwards of nine thousand photographic pictures of the solar disc have been taken. These researches, and those of Carrington, extending over many years, have shown that though the spots, if observed from day to day and month to month,

appear to break out capriciously both in point of size and position, yet when observed perseveringly for a series of years, a recurrence of phenomena, so far at least as the total area covered by spots is concerned, becomes evident. The period required to complete this cycle is variously estimated, a little over eleven years being that most generally accepted. On Thursday last, a remarkable paper by Prof. Piazzi Smyth, Director of the Royal Observatory, Edinburgh, was read at the Royal Society, in which the results given by thermometers, buried at different depths in the earth and observed for upwards of thirty years, were tabulated and discussed. The main deduction from these observations was that the temperature of the earth, divested of the effects of transient atmospheric changes, seemed subject to a secular law. This secular variation in the earth's temperature may of course be due to secular changes going on deep in the structure of the globe itself; but it may be ascribed also, and with a far higher degree of probability, to changes in the heat-supplying power of the sun.

There is one extremely important fact connected with these changes, namely, that one of them is accomplished in $11\frac{1}{10}$ years; that is, exactly in the sun spot periods as determined by Wolf, and identical, or nearly so, with the period obtained from the Kew observations.

But the spots are only one of the known evidences of changeful activity going on in the great central luminary. The form, disposition, and dimensions of the prominences, and the distribution of the chromosphere, are visibly undergoing constant alteration. May these phenomena not also have their period of recurrence? And may not they, equally with the spot outbreaks, stand in some relation to what formerly used to be considered purely terrestrial phenomena, namely, magnetism, electricity, humidity, temperature, and rainfall? To carry the hypothesis one step further: if there is a physical relation between the solar changes and meteorological occurrences, and if the solar changes are subject to laws which cause them to recur in regular series, have we not in this secular arrangement a clue by means of which climatic variations may be studied with greatly increased effect? Is not, in short, the systematic study of solar phenomena extremely important from a meteorological point of view?

If this hypothesis, which is one daily gaining strength, be but probably sound, the careful observation of the physical phenomena of solar eclipses becomes an urgent necessity, as calculated not only to afford more just and more noble views of the constitution of the universe, but to confer on mankind the same power with respect to climatal vicissitudes, which we already possess with respect to astronomical phenomena, the power of confident prediction, which will never be ours until we have a firm grasp of the secular laws by which those vicissitudes are governed.

If these views be generally accepted, as we know they will be by those acquainted with the subject, we need not fear that anything which the knowledge and devotion of our astronomical physicists, or the power of the Government, can supply, will be wanting to effect the due observation of the Solar Eclipse of December in a manner creditable to our age and our country.

A.

ON THE BASIS OF CHEMICAL NOTATION

CHEMISTS are so much in the habit of employing what are called chemical symbols, that they are liable occasionally to forget the realities symbolised; while persons interested in the realities of chemistry, but not themselves chemists, are apt to call in question the propriety of employing any such symbols at all,—looking upon the entire system of chemical expression as an arbitrary one, having its chief warrant from authority, and not only throwing an unwarrantable gloss upon the facts, but frequently overshadowing them. That the accepted system of chemical notation is, indeed, to some extent arbitrary, and that it does throw more or less gloss upon the facts, may be admitted at once as indisputable; but nevertheless its relation to the facts is so simple and direct, and its utility as a means of illustrating and classifying the facts is so remarkable, that its justification ought not to prove a seriously difficult labour.

It being the especial business of chemists to consider every material object in relation to the kind of matter of which it is composed, they have gradually become acquainted with about sixty different kinds of matter that are unalterable in their kind by way of subtraction. The entire matter of a piece of iron, for instance, may cease to exist as iron, and, by an accretion of other matter, appear in the form of rust. But, though alterable in this way by the addition of other matter than iron to it, it is experimentally unalterable by the subtraction of other matter than iron from it. Now the sixty or more different kinds of matter having this property of unalterability by subtraction, though never declared to be in their essence elementary, are always tacitly assumed to be so; and chemical changes are accordingly interpreted in a definite way which, on this particular assumption, would appear to be the only legitimately possible way, but which, irrespective of this particular assumption, can only be regarded as one of several more or less probable ways.

Making the assumption, however, with eyes shut or open, as the case may be, chemists are able to learn, by analysis, the respective weights of the different elementary substances constituting a given weight of any compound substance. The results of the analyses are, of course, expressible in various modes; the most obvious, and, so to speak, impersonal mode, being the centesimal one—the setting forth of so many parts by weights of the respective constituents in 100 parts by weight of the particular compound. But in the case of several different compounds having one or more common constituent, the relationship of composition subsisting between the different compounds is much better brought out by taking some common constituent as a constant, and the other constituents as variable in relation thereto, rather than by taking all the constituents alike as variable.

Now, among the sixty or so elements, hydrogen is characterised by this peculiarity, that in nearly all the compounds of which it is a constituent, it exists in a smaller proportion by weight than any other constituent, while in absolutely all its compounds it exists in a smaller proportion by weight than some other constituent; so that in the compounds which it forms with but one other kind of elementary matter, its proportion by weight is always less than that of the other elementary matter with which