SUNLIGHT AND SKYLIGHT AT HIGH ALTITUDES.*

By CAPTAIN W. DE W. ABNEY, R.E., F.R.S.

DURING the end of June and beginning of July the author paid a visit to the Riffl, above Zermatt, which is at an altitude of about 8,500 feet, in order to study spectroscopically solar light. The air there is very dry, the wet and the dry bulb sometimes reading a difference of 7° or 8°, the wet bulb being near by 32°. The author was much struck with the exceedingly black blue sky which was apparent at this altitude, and during his researches he carried on also an examination of the light from this blue sky composing it. The spectroscope, combined with photography, showed that the sky spectrum was very feeble compared with that of the sky in England, the maximum of intensity lying near H in the extreme violet, while in the latter case it was somewhere near G. The intensity of this violet band was only about one-fifth, and the total photographic effect was somewhere about one-twentieth of that found in an English blue sky. In observations of direct sunlight the total photographic effect on silver bromide was, probably, doubled, owing to the enormous increase in the ultra-violet rays. These rays, usually so invisible, could be viewed for a long way up the spectrum, showing that with sufficient intensity the eye is sensitive to this class of radiation. These observations show the difficulty that photographers at this altitude meet with in securing good pictures. The highest lights have double the brilliancy, and the deep shadows only one-tenth the illumination, of the same objects when photographed from below, always supposing that the principal part of the illumination of the shadows comes from the sky. The author then traced this blueness of the sky and the increase in the ultra-violet of the direct sunlight to absence of "water stuff," and dust left below in the bottom one-third of the atmosphere which existed below 8,500 feet. Observations at the zenith and horizon, both at high and low altitudes, were undertaken to confirm or disprove the above statements. Another confirmation was that, although the rain-band was often visible at Zermatt, 3,000 feet below, yet it was never visible at the Riffl except when rain was absolutely falling. The examination of the intra-red region of the spectrum showed that none of the absorption lines could be traced to atmospheric causes, and that they must be due to matters either in the sun itself or between our atmosphere and the sun. In the case of the benzine and alcohol, which were shown to be present, the probability was that they were in space, since their traces had not been found in the solar spectrum during the recent eclipse. The effect of moisture in the atmosphere apparently is the same as if a solar spectrum in dry air were photographed. I had from three inches to two feet of pure water. No increase of lines is found, but only the shaded bands which are found in the absorption spectra of water. The author also made some remarks on the A and B lines, which were certainly not due to atmospheric causes, but must be located in the sun or in space—in which he did not say.

The chairman observed that those who doubted the diffusion of alcohol throughout the universe might be glad of an opportunity to refute it.

Mr. J. Glaisher said he had never failed up to five miles in getting a deposition of vapor, and there was no part of the earth's atmosphere probably in which there was no aqueous vapor. At a height of seven miles in a balloon he had seen cirrus clouds still higher, and there was a great difference between the state of the atmosphere in a free balloon and on a mountain side.

DETECTION OF FUSEL OIL.

FUSEL oil consists chiefly of amyl alcohol, and although the latter differs very much in taste, smell, and physiological properties from ordinary alcohol, its presence in small quantities in brandy, whisky, etc., is not easily detected; the estimation of the quantity present was scarcely possible. L. Marquardt, of Hamburg, believes that he has solved this problem. Without entering into the details of the quantitative analysis, which is exceedingly tedious, we will only say that his process consists in first extracting the fusel oil with chloroform, washing thoroughly, and then oxidizing the amyl alcohol to valerianic acid by means of bichromate of potash and strong sulphuric acid at 185° F. The odor of the acid is easily recognized.

ON A SUPPOSED CONNECTION BETWEEN THE HEIGHTS OF RIVERS AND THE NUMBER OF SUNSPOTS ON THE SUN.

By PROF. BALFOUR STEWART, M.A., LL.D., F.R.S.

WHILE a connection between the state of the sun's surface as regards spots, and the magnetic state of the earth, may be considered as well established, the fact of a connection between sunspots and terrestrial meteorology is still *sub judice*, and without attempting to assert the truth of such a connection, the following may perhaps be regarded as a slight contribution tending to throw light upon the subject. The heights of the rivers Elbe and Seine have already been examined by Fritz, who reported in favor of such a connection as would make a great height correspond to a large number of sunspots, and all that I have done has been to treat the evidence in a somewhat different manner. I divide each sun period without regard to its exact length into twelve portions, and put together the recorded river heights, corresponding in time to similar portions of consecutive sun-periods. I find by this means residual differences from the average, representing the same law whether we take the whole, or either half of all the recorded observations, and whether we take the Elbe or the Seine. This law is that there is a maximum of river height about the time of maximum sunspots, and another subsidiary maximum about the time of minimum sunspots. It is of interest to know whether the same behavior is followed by the River Nile. Through the kindness of General Stone Pacha, and through the Science and Art Department, South Kensington, information has been obtained about this river. This information shows us that the Nile agrees with the European rivers in exhibiting a maximum about the times of maximum sunspots and a subsidiary maximum about the time of minimum sunspots, only the subsidiary maximum is greater than for the European rivers already named. It also appears that the date of maximum height of the Nile is 11 years on these years for which the yearly height is greatest. Now the present year is, perhaps, not very far removed from

a solar maximum, and I am thus induced to think that the Nile may this year be somewhat late in attaining its maximum rise.

PRESENTATION OF A MEDAL TO M. PASTEUR.

THE wonderful discoveries made by M. Pasteur have for a long time past placed him in the front rank of science, which he continues to serve with the greatest *éclat*. A committee composed of members of the Academy of Sciences, of the Academy of Medicine, of the Society of Agriculture, of the Faculty of Medicine and higher Normal School, was not long since formed, under the presidency of M. Dumas, with a view of offering him a medal commemorative of his many works. The execution of the medal was

MEDAL PRESENTED TO M. PASTEUR BY HIS ADMIRERS.

intrusted to M. Alph. Dubois. On the 25th of June, Messrs. Dumas, Boussingault, Jamin, Bouley, and Daubrée, members of the Institute; Bertin, Director of Studies at the Normal School; Davaine and Villemin, members of the Academy of Medicine; and Tisserand, Director of Agriculture and Commerce, proceeded to the laboratory of M. Pasteur, where they found him surrounded by the members of his family. The medal was presented to the distinguished investigator, with appropriate remarks, by M. Dumas.

We give herewith, from *La Nature*, an engraving showing the obverse and reverse sides of the medal.

SIR ERASMUS WILSON'S MUNIFICENT GIFT TO MARGATE.

At a recent meeting of the Governors of the Margate Royal Sea Bathing Infirmary, Sir Erasmus Wilson, F.R.S., handed over the key of the magnificent new wing of the Infirmary, to be named the Erasmus Wilson wing, which he has built at an estimated cost of over £150,000. The wing includes two large day-rooms and four dormitories, each to contain sixteen beds, with a swimming bath capable of containing 15,000 gallons of sea water.

WRECK OF THE MOSEL.

THE steamship Mosel, belonging to the North German Lloyd's Company, a large and splendid vessel, which left Southampton for New York on the 8th of August, was involved in a thick fog at the mouth of the Channel; and at half past eight next morning ran upon the rocks at Church Cove, one mile east of the Lizard Point of Cornwall, England. She had come from Bremen with 650 German emigrants, and with a general cargo for the United States, and had taken on board mails and specie at Southampton. The ship was going thirteen knots an hour when she struck stem first, and her bow was lifted so that she instantly forged

ahead, with large rocks under her entire length. There was no alarm on board, as the ship maintained an upright position, and the captain assured the passengers that they would all be landed safely. The National Life Boat Institution's life-boat Anna Maria, under the direction of the Rev. P. Vyvyan Robinson, was soon alongside, and prompt measures were taken by means of both ship and shore boats for landing the passengers. It was nearly low tide, and cables were speedily got out and made fast on shore. As the tide rose, some of the ship's compartments began to admit the water. It became necessary to quit the ship, which may yet be saved, with the cargo, but happily there was no loss of life. The steamer Rosetta, of Falmouth, which was cruising in the neighborhood, took the mails and specie to Falmouth, whither the passengers were also conveyed. The greater

part of the cargo was got out of the ship, soon after which she became a total wreck. Our engraving is from the *Illustrated London News*.

BULLIVANT'S SEA ANCHOR.

ONE of the attractions at the Exhibition of Life Saving Appliances at the Alexandra Palace was the sea anchor of Messrs. Bullivant & Co., of 72 Mark Lane, London. This anchor has been invented for the purpose of enabling disabled vessels to ride out heavy gales and storms, and for other similar purposes. The application of the anchor is seen in Fig. 1 of the engravings on p. 139, while Fig. 2 shows it in detail. It will be seen to consist of an oblong raft, to which is attached canvas bags or drogues, the same length and breadth as the raft. The dimensions of the raft and drogues may be regulated to offer varied resistances adaptable to small or large vessels. The raft or float may be made either of well-seasoned wood, well calked, or of iron or steel. It is constructed with floating power sufficient to support the bags with their expanding bars, and steel wire rope pendants, and the weight of steel wire towing hawser, which would be brought upon it. At the front of the raft eye-bolts are placed to receive the steel wire towing span, and a strongly hinged flap one foot in depth is also dropped in a vertical direction in front of the raft to give additional resisting force in dragging. The bags are attached by means of shackles and steel wire pendants to eye-bolts at the back of the raft and connected to each other by short steel wire pendants and shackles. These bags are extended by means of a bar-iron rim at the mouth of each bag, stiffened with a cross bar of iron at the center of each. The sea anchor when stowed away occupies a very limited space. The bags lash close to the raft, and the whole may be secured to the bulwarks on the outside of the bow of a vessel. In this position the anchor is always ready for immediate use. It can be supplied with varied resisting areas, to meet the requirements of any class of vessel. The re-

WRECK OF THE NEW YORK AND BREMEN STEAMSHIP MOSEL, AT THE LIZARD POINT, CORNWALL, ENG.

* Abstract from a paper before the British Association.