

resistance above 30,000 would not be a singular case. I could tell something of galvanometers of 1869, comparable only to submarine cables of 1857. I refrain:—but let makers of galvanometers, Ruhmkorff coils, and electromagnets beware; surely NATURE will find them out if they do not reform before 1872. W. THOMSON

THE GAUSSIAN CONSTANTS OF TERRESTRIAL MAGNETISM

I THINK you will be doing good service to the cause of Natural Science by giving insertion in your valuable pages to the following translation of a notice which appeared in No. 1,825 of the *Astronomische Nachrichten* (Vol. 77, p. xi), on the subject of Prof. Petersen's recomputation of the Gaussian Constants of Terrestrial Magnetism, in aid of which the British Association at their last meeting voted a grant of money. It has been communicated to me by Prof. Erman of Berlin, who, in reference to the grant in question, writes as follows:—"This new act of British generosity would in other times have scarcely needed a special mention, being equalled by so many former ones of the same kind; but in the present moment, when the raging war makes petty jealousies spring up between our two befriended [friendly] nations, it is a most sacred duty to publish the fact of two Prussians having found in England a most generous and most wanted help for their scientific endeavours."

Mr. Petersen's calculations are progressing in a very desirable manner, and he hopes fully to bring them to their end (D.V.). J. F. W. HERSCHEL

Collingwood, Jan. 21

TRANSLATION

"We learn by a communication from Prof. Erman that M. Petersen, of Kiel, has undertaken to extend his great work on Terrestrial Magnetism, so as to afford for the whole earth, and for the epoch 1829, a *Fundamental Determination of the Potential Constants*, which, according to laws yet unknown, are subject to secular variation. From the knowledge of these fundamental values so obtained by the researches of Erman and Petersen, will then come to be securely connected, as a second step in advance, the determination of the laws of secular change. Since, however, the material obstacles to so laborious a work, with whatever personal devotion, would have proved insurmountable without public aid, it becomes our duty most gratefully to announce that such aid has been granted from the same quarter which afforded it to the earliest portion of this undertaking. The British Association for the Advancement of Science, at its last annual meeting, has appointed a committee, consisting of Sir J. Herschel and Prof. A. Erman, for the purpose of engaging M. H. T. R. Petersen to prosecute the continuation of his computations of the constants in question for 1829, so as to embrace all observations not included in the previous calculations, and to this end has placed a sum of 50*l.* at their disposal.

"In pursuance of this object Prof. Erman addresses to the readers of this notice his request for the communication of citations of, or references to, works and treatises or essays in which may be found recorded measured values for any station of the globe, of the magnetic *declination*, *inclination*, and *intensity* during any portion of the last ten years, as also any researches on the annual variations of these elements at determinate stations. Of course it is not meant to call for even an approximately complete catalogue of works of this kind, to furnish which would of itself require no small amount of labour. But many astronomers [and others] must have access to a variety of journals, accounts of travels, records of measures and observations, &c., which may not have come under the notice of Messrs. Erman and Petersen,

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notices of which, communicated to the Editor of the *Astronomische Nachrichten* * in the form of a letter, with a postscriptum or memorandum such as:—Magnetic Observations for 18 . . . are to be found in . . . Volume . . . page . . . are requested."

ACCOUNT OF THE AUGUSTA ECLIPSE EXPEDITION

IN consequence of the unfortunate wreck of the *Psyche* on a sunken rock on the coast of Sicily, about nine miles north of Catania, the arrangements of the Sicilian Expedition were considerably modified. Catania was made the headquarters of the expedition, and the garden of the Benedictine Monastery was given up by the authorities of the city to the English and American observers. It was finally arranged that Prof. Roscoe should take charge of the Etna Expedition, and I was asked by Mr. Lockyer to take charge of the Expedition to Augusta. Mr. Brett, Mr. Burton, Mr. Clifford, Mr. Ranyard, Mr. Samuelson, and myself formed the party.

It was also arranged with Mr. Ranyard at Catania, that on the morning of the 22nd, he and another of our party should drive some miles up from Augusta in the direction of the hills of Carlentini, to observe the Eclipse. At Augusta we were to live in camp, and Colonel Porter, with a body of sappers, had been landed there by the *Psyche* on her way to Naples.

Mr. Brett and Mr. Ranyard went first to Augusta to make arrangements with Colonel Porter for our encampment and observatory, and they met with every assistance from the Syndic of the City of Augusta, and were very kindly received by the Italian astronomers, among whom were Prof. Cacciatore, Prof. Donati, Father Secchi, and Father Denza, who were stationed inside the fort. Our encampment, and a wooden observatory sixty feet long, were pitched on the southern slopes of the glacis of the fort, with a full view of the sea to the east.

I cannot speak too highly of the way in which Colonel Porter exerted himself to make all arrangements satisfactory and complete, and even to introduce elements of comfort into our camp life; and the energetic way in which his men carried out his instructions is beyond all praise. Up to Monday the 19th, the terraces of the Monastery at Catania were made the general practising ground, and those who were to observe for polarisation, except Mr. Ranyard, who was at Augusta, tested and compared their instruments for rapidity of correct observation, and for delicacy.

For my own telescope I had two eye-pieces, one with plates of double-rotating quartz, and the other with a Savart polarimeter. When the polarisation was not very strong, I found the polarimeter more delicate than the bi-quartz for detecting the plane of polarisation, and with it I was able to measure the amount of polarisation readily. On observing the same points with Mr. Griffiths, who also used a Savart polarimeter, we found that in from ten to fifteen seconds we could determine the plane and amount of polarisation, and in some cases we found that our readings for both were absolutely identical.

At about 6.30 on Monday evening, and again soon after 7 o'clock, when Mr. Clifford and I were on the sea on our way to Augusta, we saw a brilliant display of the zodiacal light, consisting of brilliant pink streamers, stretching up perpendicularly to the horizon, the planet Jupiter being just on the most brilliant streamers. Towards the north and round the horizon there were also streamers and a faint hazy light, and the sky became covered with a pinkish mauve colour. One of these displays was also seen by the rest of our party at Augusta.

As the evening grew darker, there was strong phosphorescence on the sea. The drops scattered by the oar as it struck the water glowed with phosphorescent light, and the forms of the eddies, caused by the bending of the oar, were distinct and brilliantly illuminated.

At Augusta, through the kindness of Prof. Cacciatore and Father Denza, I was able to obtain the latitude and longitude, as well as the local times of the different phases of the Eclipse:—

Latitude of Fort Augusta	37° 74'	0'' 6	N.
Longitude	14	0'	52'' 2 E. of Greenwich.
Local time of beginning of totality	2h	2'	56'' 7
" middle	2h	2'	52'' 1
" end	2h	3'	47'' 3
Making the duration of totality	1	50''	8

The barometer fell from the morning of the 20th to the morning of the 22nd, then rose a little, and again began to fall about 12 o'clock, and was lowest about the time of totality. On the evening of the 21st the Italian astronomers reported to us the bad state of the weather throughout Italy and Sicily, the wind being westerly, and that a sirocco was expected everywhere. From about 2 o'clock in the night there was a heavy storm of wind and rain, with thunder and lightning, and our tents were in danger of being blown away. By 6 o'clock the rain had ceased, and the wind moderated, but there were still frequent flashes of lightning on the eastern horizon; in half an hour thick clouds had again covered the sky, and we had rain. The wind again became violent, and swept away the clouds, but the weather did not look promising.

According to previous arrangement, Mr. Ranyard started in a carriage to go up to the hills, and Mr. Samuelson accompanied him, and they took two sappers with them.

When the moon had entered about one-third of her diameter Mr. Brett, with his 8.5 inch reflector, observed the corona round the limb of the sun as a hazy light most brilliant nearest the sun's limb, and the limb of the moon could be traced on this corona for about 2' from the cusps. On these points Mr. Burton confirmed Mr. Brett's observations. Soon after a sudden chill was felt, and there was a sudden change in the light. About three minutes before totality there were brilliant and very remarkable patches of red and yellow light on the cloud to the right of and below the sun. Mr. Burton describes them as bows, apparently concentric with the sun. During the morning Mr. Burton had been able to indicate the positions of some of the most remarkable prominences, but the stormy wind prevented him from mapping them accurately. Father Secchi had also kindly sent us the positions of those which he had observed.

Just before totality, Mr. Burton saw and made a diagram of a prominence at the lower horn, and saw several lines in the spectrum of the chromosphere between D and E. Using his large telescope Mr. Brett was able to make a sketch of the corona during the totality.

On account of the cloud, Mr. Burton was able to make only one of the four observations he had hoped to make on the Corona with his five-inch equatorial and spectro-scope. At the beginning of totality, placing his slit tangential and very near to the east limb, but not on a prominence, a bright line was distinctly seen in the spectrum, very near E, and a little less refrangible. The line was less defined than the hydrogen lines of the prominence. No dark lines were seen on the Corona.

At the end of totality, Mr. Burton had a momentary glimpse of the Corona, but had no time to get the telescope on it before the totality was over. With regard to the amount of light, he says that it was sufficient to see a pencil diagram at a distance of two feet from the eye. I can confirm him in the view that the darkness was not intense, and have no doubt that the diffusion of light by the cloud gave us more light than we should otherwise have had. Venus and some stars were seen.

Colonel Porter had kindly volunteered to make a sketch of the Corona, but the cloud prevented him from obtaining any satisfactory result.

I did not see the Corona at the beginning of totality with my telescope. As the band of sunlight became exceedingly thin, and at the instant of its disappearance

broke up into sections, I could not decide whether the lunar mountains had pierced the rim of light, or whether the dense cloud coming over the moon had cut out certain portions of the rim before obscuring the whole.

After this, I could detect nothing of the disc of the moon for a full minute, then the cloud became thinner, and I found that by slowly moving the telescope I had kept the moon in the centre of the field. At the top and bottom, the limb was visible, but no light was seen outside it at these points. I saw light of the Corona near the point of beginning of totality covering some 20° of the limb, and also a trace of light near the point of emergence. I could not perceive any colour on these portions of the Corona, nor could I detect any difference of colour on the two plates of my bi-quartz, the line of division of which was at right angles to the sun's path, *i.e.*, inclined at 15° to the vertical. The moon was again observed, and again I detected light near the point of emergence, and placed the line of division of my bi-quartz radial to the moon, having the light in the centre of the field, but I could detect no trace of colour on the two parts of the crystal, showing that the bi-quartz was not sufficiently delicate to detect the polarisation under such unfavourable circumstances. The rim then became continuous, and the totality was over.

Mr. Clifford observed polarisation on the cloud to the right and left and over the moon, in a horizontal plane through the moon's centre, and found the plane of polarisation to be inclined at from 15° to 20° to the vertical towards the west. At his last observation, which was on the moon, when it could be seen near the end of totality, he determined the plane of polarisation to be vertical.

The comparisons made at Catania, as well as a comparison of my observations with Mr. Clifford's, seem to show that bands, rather than a difference of shades of colour, should be employed to detect delicate polarisation.

Mr. Ranyard had a very clear view at Villasmunda, although it was raining during the totality, and made three observations, two of which he described to me as agreeing with what should be observed in the case of radial polarisation.

Mr. Samuelson and the two sappers made independent rough drawings of what they saw, and their drawings agree well as to the Corona and the positions of the rays. Mr. Samuelson also used a Nicol's prism, with Savart's bands, to determine the polarisation on the sky at three points, and at two of these points found the plane of polarisation vertical.

I have not yet seen the details of Mr. Ranyard's or of Mr. Samuelson's reports.

Although the other successful observers of the Eclipse in Sicily were not attached to the Augusta expedition, of which Mr. Lockyer had put me in charge, I may add that at Syracuse the weather was favourable, and Mr. Griffiths was able to determine the plane and amount of polarisation at different points of the Corona; also, that Messrs. Brothers and Fryer were able to take some good photographs of the Corona, one of which is very remarkable for its clear definition of the Corona and of the rays extending out to a distance of two diameters from the moon's limb. This photograph and a careful sketch of the Corona by Mr. Watson, one of the American observers, show a very remarkable agreement, and prove the existence of the remarkable dark cusps on the Corona.

At Augusta, two bright lines were seen in the spectrum of the Corona by Father Denza, one of the Italian astronomers, but no dark lines have been seen.

We experienced every kindness from the Italian astronomers at Augusta and from the authorities; and, on the day after the Eclipse, we were invited by the Syndic of the City to meet the Italian Astronomers at a grand public dinner given by the City in honour of our visit.

King's College, Jan. 16

W. G. ADAMS