showed a negative electrification from fully $\frac{1}{2}$ volt, in ten minutes, down to $\frac{1}{18}$ volt.

Additions of very small quantities of washing soda to water greatly reduce the positive electrification obtained.

Loch Katrine water, supersaturated with carbonic acid, and placed in the insulated jar, showed, when air was bubbled through it for ten minutes, a negative electrification of $\frac{1}{4}$ volt.

§ 22. Ten drops of paraffin oil added to water reduced the electrification to about half of that obtained from water only. Thirty drops reduced it to about a tenth, which, as it amounted to only 0·4 volt during the time of the experiment is negligible.

§ 23. Ten drops of benzene reduced the electrification to half, and thirty drops to about a third of that taken by pure water.

§ 24. A saturated solution of granulated phenol (carbolic acid) was made, and small portions of it added to the water in the jar. Several experiments showed no diminution in the electrification as long as the quantity of the phenol solution present in the water was under 10 per cent. With 25 per cent. the electrification was reduced to a third. With strengths greater than this up to saturation the electrification was reduced to one-sixth.

§ 25. A saturated solution of common salt was prepared. Blowing air through 200 c.c. of water containing the quantities of the salt solution mentioned, gave us in ten minutes the following electrifications :—

Per cent. of saturated solution of salt in water.	Volts positive.
(*a*) 0·004	2·4
(*b*) 0·02	1·2
(*c*) 0·1	0·6
(*d*) 0·5	0·4
(*e*) 2·0	0·15
(*f*) 4·0	0·0

§ 26. Several experiments showed that with 200 c.c. of water containing not more than ten drops of absolute alcohol, practically the same amount of positive electrification (4 volts in ten minutes) is obtained as if pure water were used. With fifty drops less than 2 volts were got, and with 100 drops less than 1 volt. 25 and 50 per cent. alcohol in the water gave very small and hence negligible positive electrification.

§ 27. One drop of saturated solution of copper sulphate in 200 c.c. of water showed one volt positive in ten minutes. With $\frac{1}{2}$ per cent. of it in the water, the electrification was reduced to a fraction of a volt positive. With greater proportions of copper sulphate present, up to saturation, slightly negative electrifications were obtained, but never amounting to more than about one-tenth of a volt, and hence negligible.

§ 28. On blowing carbonic acid gas from a cylinder obtained from the Scotch and Irish Oxygen Company, through pure water in the glass jar, the water became electrified to $8\frac{3}{4}$ volts positive in ten minutes. Blowing the breath through water gave an electrification of 3 volts positive in the same time: this diminished result is doubtless due chiefly to the diminished rate of bubbling.

§ 29. The blowing of oxygen from a cylinder, obtained from the Oxygen Company, through water, gave as a mean of four experiments a positive electrification to the water of half a volt in ten minutes. When continued for fifty-five minutes, it gave the very decided result of 5 volts positive.

§ 30. Hydrogen prepared from zinc and dilute sulphuric acid was passed into a large metal gas-holder; and was passed on from this to bubble through the water in the insulated jar. In two experiments this was done immediately after the preparation of the hydrogen; in another it was done after the hydrogen had remained eighteen hours in the gas-holder. In each of the three experiments the water was electrified to 2 volts positive in ten minutes.

When the hydrogen was allowed to pass direct through a tube from the Wolffe's bottle where it was generated, to bubble in the insulated jar, the magnitude of the effect obtained was very much larger. In one case a mixture of muriatic acid and sulphuric acid and water was used, and the reading went off the scale positive in thirty seconds (more than 10 volts). In other two experiments with dilute sulphuric acid and zinc in the Wolffe's bottle, the electrifications obtained were 6 volts positive in seven minutes, and 7·3 volts positive in thirteen minutes, in the last of which the hydrogen was allowed to bubble through caustic potash contained in a small bottle between the Wolffe's bottle and the insulated jar.

The hydrogen was next generated in the insulated jar itself, the tube for ingress of air used in the ordinary experiments being taken away. 200 c.c. of pure water, along with some granulated zinc, was put into the jar. Then some pure sulphuric acid was added, and electrometer readings were taken. In two experiments with no screen in the jar (§ 16) the reading went off the scale *negative* (1) in two minutes and (2) in four minutes (more than 9 volts in each case). In another experiment in other respects the same, but with a copper screen 7 cm. above the surface of the liquid, the electrification showed 2 volts *negative* in two minutes, then came back to zero in five minutes, and in the next six minutes went 4 volts *positive*. The jar and pair of quadrants connected with it were then metallically connected with the outer case of the electrometer for a few seconds, and reinsulated; in five minutes the reading went up to 2 volts *positive*. A little more sulphuric acid was added to the jar, which was disinsulated for a short time and reinsulated; the reading went up to 7 volts *positive* in four minutes. The jar was again disinsulated for a few seconds and reinsulated; the reading went up in four and a half minutes to $6\frac{1}{2}$ volts *positive*.

§ 31. Coal-gas, bubbled through water in the insulated jar, gave 1·4 volts positive in ten minutes.

§ 32. In the ordinary experiment of bubbling air through a small quantity of water in the bottom of the jar it was noticed that the electrification did not commence to be perceptible generally till about the end of the first minute; and that it went on augmenting perceptibly for a minute or more after the bubbling was stopped. The following experiment was therefore tried several times. One of us stood leaning over the jar, with the head about 10 inches above it, and the mouth so partly closed that breathing was effected sideways; another blew the bellows, and another took the readings of the electrometer. After bubbling had been going on for some minutes, and the readings were rising gradually (4 volts per ten minutes, as in § 18), blowing was stopped. As soon as the bubbling ceased, the first-mentioned observer, without moving his head or his body (see § 7, regarding the necessity to have the electrometer screened from outside influences), blew into the jar to displace the negatively electrified air in it. In every case the electrometer reading showed instantly a small rise in the positive direction.

In the carrying out of these experiments we have received much valuable help from Mr. Walter Stewart and Mr. Patrick Hamilton.

§ 33. The very interesting experiments described by Lenard, in his paper on the Electricity of Waterfalls (*Wiedemann's Annalen*, 1892, vol. 46, pp. 584–636), and by Prof. J. J. Thomson, on the Electricity of Drops (*Phil. Mag.* April 1894, vol. 37, pp. 341–358), show phenomena depending, no doubt, on the properties of matter, to which we must look for explanation of the electrical effects of bubbling described in our present communication, and of the electrification of air by drops of water falling through it, to which we have referred as having been found in previous experiments which were commenced in 1890 for the investigation of the passage of electrified air through tubes.[1]

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Isaac Newton Studentship in Astronomy has been awarded to Mr. S. S. Hough, Scholar of St. John's College, Third Wrangler in 1892, and Smith's Prizeman in 1894.

Mr. C. T. Heycock, Lecturer in Chemistry at King's College, First Class in the Natural Sciences Tripos 1889 has been elected to a Fellowship.

The discussion by the Senate of the proposals for the encouragement of Advanced Study and Research, by the admission under special conditions of Graduates of other Universities, was on the whole favourable to the scheme. There seems little doubt that the preliminary resolutions on the subject will be passed early next term.

Mr. Arthur R. Hinks, of Trinity College, has been appointed Second Assistant at the Observatory for five years, from July 1, 1895.

[1] "Electrification of Air by a Water Jet." By Magnus Maclean and Makita Goto, *Phil Mag.* August 1890, vol. 30, pp. 148-152.

SIR JOHN LUBBOCK has been elected President of the London Society for the Extension of University Teaching, in succession to Mr. Goschen, M.P., resigned.

MR. GILBERT R. REDGRAVE has been appointed Chief Senior Inspector of Schools and Classes under the Science and Art Department, and Mr. T. B. Shaw, Inspector of the North-Western District, has been promoted to a Senior Inspectorship.

SCIENTIFIC SERIALS.

WE have received two recently issued parts of the *Journal of the Asiatic Society of Bengal* (vol. lxiii. part ii. Nos. 1 and 3) containing, *inter alia*, an important paper by Mr. Lionel de Nicéville (the author of the admirable book on the butterflies of India, Ceylon, and Burma, now approaching completion), on new and little-known butterflies from the Indo-Malayan region, illustrated by five excellent coloured plates, representing species belonging to most of the principal families represented in the district. Among the species figured is a handsome new species of *Stichophthalma* (*S. sparta*) from Manipur, allied to the well-known Chinese *S. howqua*, of Westwood, belonging to a genus allied to the great blue Morphos of South America, and not inferior to some of them in size; a gynandomorphous specimen of the common, but very remarkable, Indian Fritillary, *Argynnis niphe*, L., the female of which mimics the abundant, highly-protected, and much-imitated *Danaus chrysippus*, L.; several species of *Laxita*, Butler, a beautiful genus allied to our Duke of Burgundy Fritillary, but much larger, and with rounded brown wings, generally suffused with crimson on the fore wings, and marked with metallic blue spots beneath; three species of *Papilio*, two of which mimic species of the widely-removed sub-family *Euplœinæ*; and many other interesting species. Several genera, as well as a large number of species, are described as new, and much fresh information is given relative to species already known. Several very useful lists and tables are also included in the paper, relative to the species of *Daphla*, allied to *D. teuta*, Doubleday and Hewitson, and those of the genera *Gerydus*, Boisduval, *Logania*, Distant, &c. When we look at the number of important books and papers that are now constantly issuing from the press on the butterflies of various parts of the British East Indies, it seems strange to remember that thirty years ago almost nothing had been published specially on the subject, except Horsfield and Moore's Catalogue of the Lepidoptera in the East India Company's Museum, and Westwood's "Cabinet of Oriental Entomology."

Memoirs (*Trudy*) *of the St. Petersburg Society of Naturalists*, vol. xxiv. part 1, Zoology and Physiology.—Notes on birds found in the Mediobor Mountains of Podolia, by I. D. Mikhalovsky. Seventy-two species are mentioned.—On the structures and reactions of the cells of the digestive tube of the pupæ of *Musca Cæsaris vomitoriæ*, by N. Kholin, with one plate.—The Natural History Museum of Great Britain, and other zoological institutions of West Europe, by A. Yaschenko.—Report on the cruise of the *Nayezdnik* in the Arctic Ocean in 1893, by N. Knipovitch. Leaving Reval, the cruiser visited the Murman coast, the Dvina and Onega bays of the White Sea, and the west coast of Novaya Zemlya, entering the Matochkin Strait and the Yugorskiy Shar. No less than eighty successful dredgings, down to depths of 190 fathoms, as well as measurements of temperature, were made. The author's remarks on the differences of colour and density of the blue Gulf Stream water, which is easily traced along the Murman coast, and the more so along the coast of Novaya Zemlya, are especially interesting. The colour and the density better delineate the south-east limits of the Gulf Stream current than the differences of temperature which are affected in both the Gulf Stream and the cold current by various local causes. In the bays of the White Sea, M. Knipovitch found in the bottom mud, which has temperatures of one or two degrees below zero, the *Yoldia arctica*, characteristic, as is known, of the Glacial period deposits and the Arctic Seas; while the same has never been found in the Arctic Ocean off the Murman coast, nor in the eastern parts of the Barents's Sea.—Report on the zoological institutions of West Europe, by Prof. K. Sainte Hilaire.—In the *Proceedings* we notice a very interesting report, by A. A. Birulia, on the part played by the phagocytes in the sexual processes with the *Galeodes*, and A. K. Trotsin's report on his zoological journey to the Transcaspian region and Russian Turkestan.

THE *Meteorologische Zeitschrift* for January contains a careful discussion of the rainfall of the Sandwich Islands, by Dr. J. Hann, based chiefly on observations supplied by the Director of the Weather Service at Honolulu. The amount of the rainfall is subject to great fluctuations. At Hilea, Kau (on the south side of Hawaii), 44·5 inches fell in 1886, and of this amount 51 per cent. fell in November. In 1889 the annual fall was only 13·9 inches, or about half as much as in November 1886. At Honolulu the average annual fall is 40 inches. The heaviest falls occur on the windward side of the largest of the islands, that is, on the north-east of Hawaii, and the smallest falls occur on the southern part of Oahu, and the south-west of Maui. The wettest period in almost all the islands is from November to March. The principal exception to this is on the leeward side of the mountains of Hawaii, where more rain falls in summer than in winter.

SOCIETIES AND ACADEMIES.

LONDON

Physical Society, March 8.—Mr. Walter Baily, Vice-President, in the chair.—Mr. Naber exhibited, and shortly described, a new form of gas voltameter. The chief advantages claimed for this instrument are that either the oxygen or the hydrogen can be collected separately, and that the level of the liquid inside and outside the burette can be made the same; thus no correction has to be applied to the volume of the gas on this account. Variations in the temperature and barometric pressure are allowed for by reading an air thermometer which is fixed alongside the burette. The inventor considers that this instrument will compare favourably in accuracy with the copper and silver voltameters now in general use. Prof. S. P. Thompson considered that now so much care had been bestowed on the design of a gas voltameter, this instrument might come into more general use than heretofore.—Dr. Johnstone Stoney, F.R.S., exhibited (1) the local heliostat, (2) an improvement in siderostats. By a local heliostat the author means one which can only be used in places the latitudes of which differ slightly from that of the place for which the instrument was specially constructed. The limits within which the instrument works with sufficient accuracy for ordinary spectroscopic work, are such that one instrument can be used in any place in the British Isles. The heliostat exhibited was a modification of one previously described by the author, which is now in very general use, and it is capable of sending a reflected ray in any direction in, or nearly in, a horizontal plane. In the new instrument the pendulum clock previously used to supply the motive power, is replaced by a balance-wheel clock; this change decreases the cost of the instrument, while it adds to its portability. A tangent screw, worked by a long rod, supplies a slow motion for adjusting the position of the reflected beam, and is of use when examining the spectra of the solar prominences, &c. The instrument is adjusted in the meridian by means of a gnomon and horizontal divided circle which form a sun-dial. This divided circle is so arranged that it is always horizontal when the polar axis is in adjustment, and can therefore be used whatever the latitude of the station at which the observations are being made. In connection with the use of a heliostat in conjunction with a spectroscope, the author recommends, when using a grating, the introduction of a large glass prism between the heliostat and the slit of the spectrometer. An impure spectrum is thus formed on the slit, and by moving the slit to the part of this spectrum corresponding to light of the wavelength under observation, the difficulties due to the overlapping of the spectra may in a great measure be overcome. After mentioning that the great difficulty in designing a siderostat which should work with "astronomical accuracy," is to get a form of sliding motion quite free from back-lash, and which will move perfectly regularly, Dr. Stoney exhibited a model of a form of mechanism for obtaining such a motion which he had devised. The principle on which the instrument depends is that, if you have a point fixed to a circle which rolls on the inside of another circle of double the diameter, this point will describe a straight line. The smaller disc does not, in the model exhibited, roll directly on the larger