the prism-shaped steel bed, on which the middle knife-edge rests, is easily drawn out with the finger from the swallow-tail shaped rollers between which it is passed in the body of the balance. The beam can thus be easily removed and replaced. The balance rests on four feet. The stopping and raising arrangement is contained in a horizontal frame. Each weighing scale hangs on a conical point. Passing on to the reading, we find that the accuracy with which the balance works is, with 20 kg. weight, 2mg., with 500, $3\frac{1}{2}$ mg.; and this is gained by substituting for the pointer an optical arrangement on the beam, consisting of two achromatic glass prisms, which render parallel the rays from opposite directions and send them to a telescope placed before the balance. At the two sides of the balance, about 2m. to 4m. from the middle knife-edge, two scales are set (best on the walls of the room); the images of these scales move in the field of the telescope beside each other in opposite directions, and so the corresponding divisions can be read off. These readings are independent of vibrations of the telescope, and are much more exact than those with telescope and cross threads, not to speak of the common pointer. The arrangement also permits of the centre of gravity of the balance being placed lower, the stability increased, &c. The weight of the balance is scarcely 20 kg., though both scales can carry 20 kg. weight.

EXPERIMENTS by Forbes in 1831 and by some others since seemed to warrant the view, now commonly held, that the metals fall into the same series as regards conduction of electricity and conduction of heat, that the quotient of the heat conductivity by electric conductivity is nearly constant. Herr H. F. Weber, inclined to doubt this as contradicting the view (proved for gases and liquids) that the amount of heat transferred within a substance from layer to layer is most intimately connected with the specific heat of unit volume, made new experiments in this relation (which he has described to the Berlin Academy). He measured the heat-conduction by observing the cooling of various metal rings in a space at constant temperature, and the electric conducting power of the same rings, by noting their deadening effect on the oscillations of a magnet. The result confirmed his anticipations, the quotient of heat-conduction by electric conduction being found in the closest connection with the specific heat of unit volume. Experiments by a different electrical method for metals conducting electricity badly (lead, bismuth, &c.) and for mercury gave the same result. (Ten metals in all were examined.) On the other hand, non-metallic conductors of electricity do not show the relation in question; *e.g.* the heat-conduction of carbon is at least twenty to thirty times greater than that calculated from the electric conductivity and the specific heat. Thus the relation seems to be connected with the metallic nature of the substance. Herr Weber found the heat-conducting power of all the solid metals examined to decrease with increasing temperature, but at a considerably less rate than the electric conductivity. He further offers explanations of the erroneous view adopted, noting, *inter alia*, that the experiments in one case, though exact, were on too few metals, and these had nearly the same specific heat.

PROF. R. B. WARDER of Haverford College (Pennsylvania) and Mr. W. P. Shipley have investigated the configurations assumed by floating magnets in a magnetic fluid. They have modified Prof. Mayer's original experiment by surrounding the vessel of water with a coil of wire traversed by a current, thus producing a field of force which, while still symmetrical about the centre, differs in several respects, the lines of force not being so greatly concentrated near the centre. Diagrams of various configurations are given by these experimenters in the *American Journal of Science* for October. As even a single one-fluid cell produces a current sufficient to show these results, they ought to be easy of repetition.

A COMPREHENSIVE memoir on the theory of the radiometer, by M. Mees, appears in the *Proceedings* of the Amsterdam Academy, and (in pretty full abstract) in *Wied. Beibl.*, No. 7. The author, after criticising the various theories that have been enumerated, which he arranges in three classes, offers his own explanation of the phenomena (which cannot be briefly stated here).

A FEW months ago we drew attention to certain results published by Herr Exner of Vienna, relative to thermoelectricity, and which were at variance with all the body of evidence existing in that branch of science. Herr Exner had in fact asserted that an antimony-bismuth couple possesses thermoelectric powers only so long as one of the two metals is in contact with oxygen or with a gas capable of acting on one of them. The wish we then expressed that some independent observations might be made by other physicists has met with a response across the Atlantic. Prof. C. A. Young of Princeton, N.J., communicated to the recent meeting of the American Association a paper on the thermoelectric power of a platinum-iron couple *in vacuo*. The crucial experiment was made with an exhausted glass tube containing an iron wire with platinum terminals, the terminals being again fastened to iron wires leading to a galvanometer. The tube was exhausted to one-millionth of an atmosphere. On laying the apparatus in the sunlight and alternately shading the internal or external junctions an electromotive force could be produced, which was found to be equal in every case. The conclusion Prof. Young draws from the experiment is that Exner is wrong in his statement that thermoelectric electromotive force is due to the action of the gaseous media in which the metals are plunged. The experiment was conducted in Mr. Edison's laboratory at Menlo Park.

GEOGRAPHICAL NOTES

THE glacier of the Zarafshan, one of the greatest in Central Asia, which has hitherto been very imperfectly known, was explored during this summer by MM. Mushketoff, geologist, and Ivanoff. The exploration was quite successful, and at the last meeting, October 26, of the Mineralogical Society at St. Petersburg, Prof. Mushketoff read a paper on his explorations. The lower extremity of the glacier is at the height of 9000 feet. The Galtcha people, who inhabit the upper valley of the Zarafshan, have never ascended the glacier; they say that on the summit of it there are two great pillars of stone, between which the traveller must go, and that the pillars would certainly crush together if any one ventured into the icy solitude. On August 25 the party began the ascent of the glacier on a very steep slope covered with blocks and moraines. A tunnel, no less than 3500 feet long, runs under the glacier, being the bed of the Macha River. After two days' travel the party had done seven miles on the glacier. The temperature during the day was as high as 40° Cels., and during the night as low as − 8°; some Galtchas who accompanied the party fell ill with fever. On the fourth day the party reached the first watershed, or rather the first iceshed; the whole length of the glacier to this point was sixteen miles, the width being one mile; six other glaciers, each of which is greater than the greatest Alpine glaciers, fed the principal one. At the head of it there is a wide *cirque* opening to the east; several peaks around it reach 20,000 feet. The descent on the other slope of the mountain ridge was far more steep and difficult than the ascent; the crevasses are very numerous and the glacier has several great "ice-falls," the inclination of which is no less than 50 degrees; the party was compelled to make use of small anchors and to cut steps in the ice. Two men were unwell and quite unable to go further when the party reached the foot of the eastern slope, after a very difficult journey.

THE last number of the *Izvestya* of the Russian Geographical Society contains a letter from Dr. Miklukho-Maclay. After having visited the islands of New Caledonia, Lifu, New Hebrides, Admiralty, Louisiade, &c., he reached, about the end of January, 1880, the south-eastern coast of New Guinea; here he explored several points of the coast, and thence went to the islands of the Torres Strait and to Somerset, to study the population of Northern Australia. On his voyage from Vaïhan Island to Sydney he stopped at several points of the eastern coast. From Sydney M. Maclay proposes to go to Japan, and thence to return to Russia. During his stay in Brisbane he was very kindly received by the local government and by private persons, who have much facilitated his anatomical studies by allowing him to work in the old museum and to make use of the photography of the topographical department. The journey in the interior of Queensland was very much facilitated by the cordial reception he received from the squatters, and by the kind permission to travel gratuitously along all the railways. M. Maclay expresses, in a letter addressed to the *Golos*, his thanks to the Australians for the reception he met from them, and wishes that all men of science were so kindly received in Russia. On August 12 he was in the house of J. B. Bell at Jimbor, near Dalby. The Russian public subscription has already reached 606*l.* which he received at Sydney.

A GOOD example is being set by the Tashkent College. During the summer fourteen pupils of the College, under the

direction of their Professor of Natural History, M. Shelting, made an excursion in the Ala taou Mountains. Numerous measurements of heights were made during the journey, good zoological, botanical, and geological collections, for the Museum of the College, were made, and a detailed diary of the excursion was kept by the scholars. The students of the Tashkent Normal School, as well as the pupils of the College of Verny, have also made scientific journeys for the exploration of the neighbourhood, and we learn that the College of Orenburg has requested tickets at reduced rates from the railway company for undertaking next summer a series of explorations in that little known but very interesting province. We cannot but wish that the colleges and schools of Western Europe would follow these examples; what an excellent training in natural science might thus be given, and what a mass of valuable information might be collected.

THE members of the scientific expedition which was sent out by the St. Petersburg and Moscow Societies of Naturalists for the exploration of the White Sea and of the Murmanian coast of the Arctic Ocean, and which consisted of Professors Wagner, Bogdanoff, Tsenkovsky, and eight students of the University, have returned after having done some very successful work; they bring home very rich zoological and geological collections. Professors Wagner and Tsenkovsky stayed throughout the summer at the Solovetsky Islands; M. Lavroff in Kandalaksha Bay; Prof. Bogdanoff travelled along the whole coast to Vadsö; MM. Koudravtreff and Pleske, geologists, have travelled from Kandalaksha to Kola; others have explored the flora and the fauna of the ocean; Prof. Bogdanoff has also studied the fishing.

BARON A. VON HUGEL is now engaged in writing a work upon Fiji, where he travelled and spent some time, making extremely extensive and complete anthropological collections. The work will be more particularly an ethnological one, and most of the weapons, fabrics, and other ethnographic articles are being figured to accompany the text. The crania collected by Baron von Hugel have already been acquired by the Royal College of Surgeons, and exhaustively described by Prof. Flower.

WE notice the appearance of an important work published by the Russian Geographical and Economical Societies in the first volume of a "Collection of Materials for the Knowledge of the Russian Commune." It contains detailed descriptions of the communes of the Governments Ryazan, by M. Semenoff, president of the Russian Geographical Society, MM. Litochenko, Zlatovratsky, Mme. Yakouchkin, &c.; a very complete bibliographical index of the literature concerning the communes of Russia and of Western Europe.

A TELEGRAM has been received at St. Petersburg from Col. Prejevalsky, dated from Urga, the 1st inst., stating that during the spring and summer of this year he surveyed a part of the basin of the Upper Hoang-ho and the Lake Koko Nor. He also passed through Alashan, in the centre of the Gobi desert, to Urga. Col. Prejevalsky states that during the expedition he traversed a distance of 7200 versts, and that he has succeeded in obtaining valuable scientific results.

THE death is announced, on his passage home from West Africa, of Count de Semellé, who has been recently exploring on the Lower Niger.

THE new *Bulletin* of the Société Khédiviale de Géographie contains a paper by General Purdy-Pacha on the country between Dara and Henfiah El Nabass, together with a map of that portion of Darfur, and another on Medina twenty years ago, by Col. Mohamed Sadik-Bey, illustrated by two engravings.

THE Church Missionary Society have received news that the Rev. P. O'Flaherty, their new agent in Uganda, and Mr. C. Stokes, with the Waganda chiefs and a large caravan, started from Saadaui for the interior on August 9, but in little more than three weeks Mr. O'Flaherty was taken ill at Kidete, and will be unable to proceed to the Victoria Nyanza at present.

THE same Society have also received letters from various members of the Nyanza mission, giving a much more favourable report of their position in Uganda than had reached England some time back. Rev. G. Litchfield had in consequence of ill-health made an attempt to push northwards to Lado, in order to consult Dr. Emin Effendi. In this he unfortunately failed, being stopped by Kabba Rega, the king of Unporo, who has seized M'ruli and other posts vacated by the Egyptians since Col. Gordon's departure. Mr. Litchfield accordingly returned to Rubaga, and, crossing the lake, proceeded to Upui, hoping eventually to get to Upwapwa, where Dr. Baxter is stationed.

MESSRS. CAMERON AND PIGOTT, of the China Inland Mission, have made a journey of eight months through a great part of Manchuria and a portion of Mongolia. From the treaty port of Newchwang Mr. Pigott went on to Moukden, while Mr. Cameron proceeded along the coast in an easterly direction by the borders of Corea, and then northwards to Moukden. They next journeyed through part of Mongolia into Kirin, which at first they found fertile and well-wooded, but afterwards the country became wild, poor, and sparsely populated. The city of Kirin was reached by a long steep descent through fine scenery. Fine teams of oxen were here met with, comparing favourably with some of our best breeds. After spending a few days at Kirin the two missionaries returned overland to Peking, passing the Great Wall at Shan-hai-kwan or Ling-yü-hsien.

MESSRS. RILEY AND CLARKE, of the same Society's station at Chungking, have recently paid a visit to some Lolo villages in Southern Szechuen. These mountaineers for the most part live in inaccessible fastnesses beyond the reach of the Chinese authorities, and are not confined to Szechuen and Yünnan, but under the designations of Laos and sundry other names are found throughout the extensive regions of Annam, Siam, and Burmah. Hardly anything is yet known of the Chinese Lolos and their manners and customs, but before long the agents of the China Inland Mission in the south-west will, it may be hoped, find means to collect information regarding them.

ON A DISTURBING INFINITY IN LORD RAYLEIGH'S SOLUTION FOR WAVES IN A PLANE VORTEX STRATUM[1]

LORD RAYLEIGH'S solution involves a formula equivalent to $\frac{d^2v}{dy^2} - \left(m^2 + \frac{\frac{d^2T}{dy^2}}{T - \frac{n}{m}}\right)v = 0.$

Where v denotes the maximum value of the y-component of velocity;

,, m ,, a constant such that $\frac{2\pi}{m}$ is the wave-length;

,, T ,, the translational velocity of the vortex-stratum when undisturbed, which is in the x-direction, and is a function of y;

,, n ,, the vibrational speed, or a constant such that $\frac{2\pi}{n}$ is the period.

Now a vortex stratum is stable, if on one side it is bounded by a fixed plane, and if the vorticity (or value of $\frac{dT}{dy}$) diminishes as we travel (ideally) from this plane, except in places (if any) where it is constant.

To fulfil this condition, suppose a fixed bounding plane to contain ox and be perpendicular to oy; and let $\frac{dT}{dy}$ have its greatest value when $y = o$, and decrease continuously, or by one or more abrupt changes, from this value, to zero at $y = a$ and for all greater values of y.

It is easily proved that the wave-velocity, whatever be the wave-length, is intermediate between the greatest and least values of T. Hence for a certain value of y between o and a, the translational velocity is equal to the wave-velocity, or $T = \frac{n}{m}$. Hence for this value of y the second term within the bracket in Lord Rayleigh's formula is infinite unless, for the same value of y, $\frac{d^2T}{dy^2}$ vanishes.

We evade entirely the consideration of this infinity if we take only the case of a layer of constant vorticity $\left(\frac{dT}{dy} = \text{constant}\right.$ from $y = o$ to $\left.y = a\right)$, as for this case the formula is simply

$$\frac{d^2v}{dy^2} = m^2 v,$$

[1] By Sir William Thomson. British Association, Swansea, Section A.