

must be. This conclusion is further corroborated by astronomical observations. Science has recorded the passage of comets as only some minutes' distance from the surface of the sun; these bodies must have traversed the coronal atmosphere, and yet, notwithstanding the lightness of their mass, they did not fall into the sun.

I shall add here, as to the constitution of the coronal atmosphere, a few ideas which do not rigorously flow from my observations, but which appear to me very probable, but upon which the future must pronounce.

I said, *à propos* of the observations in the telescope, that the corona was shown at Shoolor with a form almost square, and that it was distinguished by gigantic dahlia-like petals. It is a fact that in each eclipse the figure of the corona has often varied; it has exhibited the most eccentric appearances. I have no hesitation in saying that this medium, now incontestably recognised, and which I propose to name the "coronal atmosphere," very probably does not represent the whole of the aureole which is seen during total eclipses. It is quite credible that portions of the rings or trains of the cosmical matter then become visible and thus tend to complicate the figure of the corona. It belongs to future eclipses to instruct us on this point. But with regard to the coronal medium itself, there is no doubt that it presents singular forms, which convey but little idea of an atmosphere in equilibrium. Moreover, I am inclined to admit that these appearances are produced by trains of very luminous and dense matter from the superior layers ploughing this troubled medium. The protuberant jets, which carry the hydrogen to such great heights, must have a peculiar influence upon this coronal medium, whose density is quite comparable to that of the cometary media.

It is, then, very probable that the coronal atmosphere, like the chromosphere, is very much agitated, and that it changes its shape very rapidly, which will explain how it presents different appearances every time it has been observed.

To repeat: I have been able to establish at Shoolor, by trustworthy and consistent observations, that the solar corona presents the optical characteristics of incandescent hydrogen gas, that this very rare medium extends to very variable distances from the sun, from half a radius of the sun to about double that at certain points; but I give these figures only as results of an observation, not as definitive. It is quite certain, moreover, that the height of the corona must be necessarily variable.

This result seems to be a considerable advance in the general problem of the corona. If our foreign rivals have not obtained a result so decisive* as those of the French mission, I believe it must be attributed to the altogether exceptional purity of the sky in the station which I chose with such pains, and also to the combined optical arrangements which gave to the luminous phenomena which it was the object to catch, an exceptional power.†

JANSEN

CHRONOMETER TESTS

THE following, which has been sent us by the Scientific Editor of *Harper's Weekly*, shows with what minuteness the scientific work of this country is studied in America, and what a critical audience we have on the other side of the water:—One of the most important services that astronomy has rendered to mankind consists in the contributions it has made to the

* M. Respighi, at Poodookotah, made observations purely spectroscopic which confirm mine; only he found the height of the corona much less, which appears to me to be due to the more feeble luminous power of his instrument.

† This paper contains only an analysis of my observations: I have not been able to refer in detail to those of other observers. I may cite, however, the important remarks of Mr. Lecky on the structure of the corona, the photographs of Coloeel Tennant, the polariscope observations made at Jafna, those of Capt. Fycers, M. Oudemans, and others.

progress of navigation, and the increased security of life and property. In this field England has always taken the lead, and the efforts of Mr. Hartnup at Liverpool are a worthy continuation of the labours of Flamstead, Bradley, and Airy. While the Greenwich Observatory has caused a great improvement in the general standard of the chronometers bought for the use of the Government vessels, Mr. Hartnup has sought to effect a similar reform for the mercantile marine. He has insisted on the vital importance to ship-masters, as well as to owners and insurance companies, of the careful determination of the rates of their chronometers as affected by temperature. The makers of these instruments and the astronomers who use them carefully have always known that which captains of vessels have been very slow to profit by—*i.e.* that the chronometers are, when made, so adjusted that they keep perfect time at two temperatures, such as 55° and 85° F., while between these limits they gain, and beyond them they lose, on the true time. It is rare that this variation in the chronometer rate can be safely overlooked by a careful navigator, though it is frequently done by those whose vessels do not carry a precious burden of 1,000 or 2,000 souls. The only excuse for this neglect is the positive assurance of the maker that the chronometer is perfectly reliable—an assurance that is often fortified by very deceitful figures. The difficulty and expense of a searching investigation into the errors to which every chronometer is liable have long been supposed by the trade to stand in the way of the introduction of such chronometers only as were of approved reliability. In order to obviate the difficulty as far as possible, the Liverpool Observatory has been constructed by Mr. Hartnup specially for the purpose of studying the rates of the chronometers that may be sent thither by captains sailing from that port. The expense of the examination given to such chronometers is comparatively trifling; and the number of chronometers submitted to him has annually increased, until by reason of the recent regulations at that port the number of examinations has amounted to between 1,000 and 2,000 annually, the same instruments having been repeatedly submitted to him. The process pursued by Mr. Hartnup consists in exposing each chronometer for a week to a uniform temperature of 55°, and determining its rate each day; it is then for another week exposed to a temperature of 70°, and then to one of 85°; the next week it is returned to the temperature of 70°, and the last or fifth week it is exposed to the temperature of 55°, as at first. By means of general laws regulating the rates of chronometers it is now possible to determine what the rate will be at other temperatures than the three above mentioned, and knowing these, the navigator is able to apply the proper correction to his time-keeper so exactly that he need never mistake his position upon the ocean.

The records of the Liverpool Observatory for the past year show—1. That the rates of about 10 per cent. of the chronometers tested (those of the mercantile marine very generally have the ordinary compensation balance) are so irregular as to render the instruments entirely unfit for nautical purposes. 2. The error of adjustment for temperature of the remaining 90 per cent. is often so erroneous as to produce a change of daily rate of many seconds, when the temperature varies but little from either of the two standard points of 55° and 85°, or thereabouts. 3. That the best made and most carefully adjusted instruments gain, on the average, daily six-tenths of a second more at a temperature of 70° than at 55° or 85°. 4. That those that have the same rate at 55° and 70°, or at 70° and 85°, lose when exposed to temperatures beyond these limits at the rate of 1½ seconds daily for a change of 15° in temperature. 5. That when the connection between temperature and daily rate has been well determined, it will remain constant in good instruments for a

long time, which need in general to be examined only once in one, two, or three years.

The vital importance of this subject to the interests of safe, speedy navigation, will be impressed upon everyone by the disaster that befell the *Atlantic*, consequent upon being some twenty miles (or ninety seconds of time) out in her reckoning.

NOTES

LAST Thursday the gentlemen already named by us were elected Fellows of the Royal Society.

THE Baly Medal for physiological research has been awarded to Dr. Sharpey.

A PORTION of the collection made by the naturalist D'Alberty in New Guinea, and referred to in our Notes last week, has already arrived in England, and at the meeting of the Zoological Society, on Tuesday, June 17, Mr. Sclater, F.R.S., announced that among other valuable species, it contained both male and female specimens of a previously unknown Bird of Paradise of the Epimachine division, with a peculiarly long and curved beak, which he proposed to name *Drepanephorus albertisi*, after its discoverer.

A PROJECT has been set on foot by Colonel Grant, so well known from his African travels, to form a loan exhibition of skulls and horns of hollow-horned animals, in order that by observation and comparison of a large number of characteristic specimens, facts may be obtained regarding the form, sexual characters, and locality of each particular species. It is proposed to have as many as from twenty to fifty specimens of each species, so as to be able to form groups representing every stage in the life of each, as also to show the varieties of species in different localities. When from three to five thousand specimens of the one hundred and fifty existing species has been promised, means will be taken to secure the most suitable place in London for their exhibition.

ARRANGEMENTS have been made, under the sanction of Dr. Whewell's friends and executors, for the publication of a life of the late Master of Trinity, with selections from his correspondence and remains. The literary and scientific remains and correspondence will be edited by Mr. Todhunter, Lecturer, and formerly Fellow of St. John's College, Cambridge. The account of Dr. Whewell's college and university career will be written by Mr. W. G. Clark, Senior Fellow of Trinity College, Cambridge. Some of the most distinguished of Dr. Whewell's friends, to whom application has been privately made, have kindly placed their papers at the disposal of the editors, and expressed their approbation of the proposed work. The editors now ask in a more public manner for the loan of letters or other materials which will assist them in their labours. Mr. J. L. Hammond, Fellow of Trinity, as the surviving executor under Dr. Whewell's will, has undertaken to receive, on behalf of the editors, any documents that may be intrusted to them, all of which will be catalogued and carefully preserved, and returned within such limits of time as may be prescribed.

A CONFERENCE took place on Saturday, in promotion of a project to which we have already alluded as the "Trades Guild of Learning," for extending the advantages of university education to the working and middle classes of this country. It is proposed that local organisations shall be formed in various towns, and put into communication with a central guild, for the purpose of defraying the cost of the attendance of duly authorised lecturers sent from the Universities of Oxford and Cambridge, to conduct classes and deliver lectures on subjects, such, for example, as Political Economy, English Literature, Force and Motion,

Astronomy, Physical Geography, &c. Technical education is to form a leading department of the scheme, and it appears that Nottingham, Derby, and Leicester have already made arrangements and fixed dates for receiving the lectures, and that the authorities of both Universities, but that of Cambridge especially, have given cordial encouragement to the idea. Saturday's conference was very fairly attended by representative working men in the capacity of delegates from societies more or less numerous and powerful, and the whole day from eleven in the morning until seven in the evening was occupied in the discussion of the project. Mr. Samuel Morley, M.P., presided for the first few hours, and was succeeded in the chair by Mr. Mundella, M.P. With them were the Rev. H. Solly, Mr. James Stuart, M.A., Hon. Sec. to the Syndicate, who is actively engaged in furthering the scheme in connection with the Universities, Mr. Webster, Q.C., and other gentlemen, and a few ladies. It was agreed that women should not be excluded from the advantages of the guild.

ON June 7 a meeting was held of the Druitt Testimonial Committee, at which it was reported that a handsome silver cup, along with 125*l.*, was to be presented to Dr. Druitt, who is still in India.

THE subscribers to the Children's Hospital, Bristol, have resolved to admit female practitioners to the medical staff of the hospital.

THE following, in alphabetical order, have passed first-class in Natural Science at St. John's College, Cambridge:—Clough, Jukes-Browne, Koch, Marshall, Sollas. Of the above, Marshall has been elected to a Foundation Scholarship, Clough, Jukes-Browne, Koch, Sollas (scholar 1872) have been awarded exhibitions.

IN the last issued Part of the *Birds of Europe*, which has just appeared, the name of Mr. Sharpe is no longer associated with that of Mr. Dresser as co-editor. The former of these two gentlemen has been compelled, on account of his many duties at the British Museum, to retire from his connection with the work which he was so instrumental in organising, and Mr. Dresser is now sole editor. The Viscount Walden, F.R.S., President of the Zoological Society, has relieved him of part of his considerable task, by undertaking to write most of the synonyms of the future parts, which will be sufficient guarantee for its accuracy and exhaustiveness.

THE concluding Part of Dr. W. L. Buller's *Birds of New Zealand* has just been issued. The genus *Apteryx*, the last discussed, and most interesting in the avifauna of these islands, is divided into four species at least, of which *A. haasti* closely resembles *A. owenii*, except in size, being considerably larger. The author also considers that the evidence, as far as it goes, is in favour of *A. haasti* differing from *A. maxima* of M. Jules Verreaux, which he thinks represents another species as large as a full-grown turkey. The Introduction contains several interesting supplementary notes; further facts are given in favour of the Quail Hawk (*Hieracida novae-Zelandiae*) being distinct from the Sparrow Hawk (*H. brunnea*); the validity of *Platycercus alpinus*, as a species, is established; the Huia bird (*Heteralocha acutirostris*) is placed among the Starlings, close to *Cradion* instead of with the *Upupidae*, and *Tribonyx mortieri* is included in the New Zealand fauna. There are seven excellent plates, and a supplementary series is promised.

THE recent changes which took place in French policy have deprived science of an active and able leader in M. Jules Simon, who was sparing no trouble to promote new inquiries and restore French science to its pristine activity. His imme-