be so well plotted on this last survey that the amount of gorge excavated since 1750 should be knowable to an acre. The west fall, then, only slightly the larger, has ever since been widening, lowering its edge, and getting more of the stream; so that the east one, comparatively stationary, retaining its height and decreasing in volume, must dry up, and its bed and all the isles become part of New York State. E. L. GARBETT

July 11

Sky Glows

EVER since the sunsets of 1883 and last year there has been at times an abnormal glare both before and after sundown. But I have seen nothing in the way of twilight effect so strange as that of Monday evening, the 6th, when about 10 p.m. a sea of luminous silvery white cloud lay above a belt of ordinary clear twilight sky, which was rather low in tone and colour. These clouds were wave-like in form, and evidently at a great elevation, and though they must have received their light from the sun, it was not easy to think so, as upon the dark sky they looked brighter and paler than clouds under a full moon. A friend who was with me aptly compared the light on these clouds to that which shines from white phosphor paint. This effect lasted for some time after 10 p.m., and extended from west to north, the lower edge of the clouds, which was sharply defined, was about 12° above the horizon. ROBT. C. LESLIE

6, Moira Place, Southampton, July 8

Black and White

MY daughter has two terriers, one black, the other white; she has noticed that in the dusk of the evening the black dog is much more visible than the white one, and has asked me the reason for this fact. I cannot properly explain why a white or light coloured garment shows much less in the dusk than a dark coloured dress, but this is a well-known fact to all sportsmen who shoot ducks at night, when it is their custom to wear a night shirt or other white dress over their ordinary costume. When the black and white dogs are playing together in the dusk of evening, the black dog can be distinctly seen when the white dog, at the same distance, is quite invisible. Will you please explain this? WM. E. WARRAND

Bught, Inverness, July 8

"Foul Water"

DURING a brief stay at Beaumaris in June 1883, and again in June 1884, I had frequent opportunities of observing the "gelatinous masses" mentioned by Mr. Shrubsole as occurring in large numbers at Sheerness-on-Sea. I first noticed them in 1883, while procuring a supply of water for my marine tanks at home. They then existed in very large numbers, and as I had no means of filtering the water before returning to Manchester, I almost expected to find it "foul" upon my arrival. I was, however, agreeably disappointed. The "gelatinous masses" had settled at the bottom of the jars, and were apparently dead. While at Beaumaris I subjected a few specimens to microscopical examination, but being busy with other work did not learn more than is given in Mr. Shrubsole's description.

Manchester HERBERT C. CHADWICK

Earthquake-Proof Buildings

UNLESS my memory plays me very false a number of lighthouses secured against earthquake shocks by saucers and balls were built in Japan just about twenty years ago from the designs of Mr. Stevenson of Edinburgh. WM. MUIR

The London Institution, Finsbury Circus, E.C.

THE QUESTION OF CIVIL AND ASTRONOMICAL TIME

ONE of the points made at the Washington Congress was that if Universal Time (surely Earth-Time or Prime Meridian Time would be a better term) were generally accepted, astronomical time might be abolished, astronomers accepting the new day of twenty-four hours commencing at midnight

Since the Congress the question naturally has been well considered, and we think it desirable that we should now refer to some of the most important opinions which have already been given, not only as regards the desirability of the change, but as to the time at which that change should be brought about.

Among the first to accept the resolution was the Astronomer-Royal, for the internal use of the Observatory of Greenwich. Many opinions were collected at an early date and forwarded by Mr. Chandler, the Secretary of the U.S. Navy to the Senate. This action grew out of an order of Commodore Franklin, the Superintendent of the U.S. Naval Observatory, to adopt the new time on January 1, 1885; this was communicated to Prof. Newcomb, the Superintendent of the *American Nautical Almanac*, and drew a reply from Prof. Newcomb, from which we make the following extract:—

"(1) The Conference expresses the hope that as soon as may be practical the astronomical and nautical days will be arranged everywhere to begin at mean midnight.

"(2) That east longitudes shall be counted as plus and west longitudes as minus.

"The first of these recommendations proposes a change in the method of counting astronomical time which has come down to us from antiquity, and which is now universal among astronomers. The practice of taking noon as the moment from which the hours were to be counted originated with Ptolemy. This practice is not, as some distinguished members of the Conference seem to have supposed, based solely upon the inconvenience to the astronomer of changing his day at midnight, but was adopted because it was the most natural method of measuring solar time. At any one place solar time is measured by the motion of the sun, and is expressed by the sun's hour angle. By uniform custom hour angles are reckoned from the meridian of the place, and thus by a natural process the solar day is counted from the moment at which the sun passes over the meridian of the place or over the standard meridian. For the same reason sidereal time is counted from the moment at which the vernal equinox passes over the meridian of the place, and thus the two times correspond to the relation between the sun and the equinox.

"It would appear that the Conference adopted the recommendation under the impression that the change would involve nothing more than the current method of reckoning time among astronomers, and could therefore be made without serious inconvenience. A more mature consideration than time permitted the Conference to devote to the subject would, I am persuaded, have led that distinguished body to a different conclusion.

"A change in the system of reckoning astronomical time is not merely a change of habit, such as a new method of counting time in civil life would be, but a change in the whole literature and teaching of the subject. The existing system permeates all the volumes of ephemerides and observations which fill the library of the astronomer. All his text-books, all his teachings, his tables, his formulæ, and his habits of calculation are based on this system. To change the system will involve a change in many of the precepts and methods laid down in his text-books.

"But this would only be the beginning of the confusion. Astronomical observations and ephemerides are made and printed not only for the present time, but for future generations and for future centuries. If the system is changed as proposed the astronomers of future generations who refer to these publications must bear the change in mind in order not to misinterpret the data before them. The case will be yet worse if the change is not made by all the ephemerides and astronomers at the same time epoch. It will then be necessary for the astronomers of the twentieth century, using ephemerides and observations of the present, to know, remember, and have constantly in mind a certain date different in each case at which the change was made. For example, if, as is officially announced, the Naval Observatory introduces the new system on January 1, 1885, then there will be for several years a lack of correspondence between the system of that establishment and the system of the American Ephemeris, which is prepared four years in advance.

"It is difficult to present to others than astronomers who have made use of published observations the confusion, embarrassments, and mistakes that will arise to their successors from the change. The case can be illustrated perhaps by saying that it is of the same kind as—though in less degree than—the confusion that would arise to readers and historians in the future if

we should reverse or alter the meaning of a number of important words in our language with a result that the future reader would not know what the words meant unless he noticed at what date the book was printed. The words would mean one thing if printed before the date of change, and another if printed after.

"It is worthy of attention that even the republican Government of France in 1790, which adopted a new calendar, did not venture to change the old system in its astronomical ephemeris.

"I see no advantage in the change to compensate for this confusion. If astronomical ephemerides were in common use by those who are neither navigators nor astronomers the case would be different. But, as a matter of fact, no one uses these publications except those who are familiar with the method of reckoning time, and the change from astronomical to civil time is so simple as to cause no trouble whatever.

"The change will affect the navigator as well as the astronomer. Whether the navigator should commence his day at noon or midnight, it is certain that he must determine his latitude from the sun at noon. The present system of counting the day from noon enables him to do this in a simple manner, since he changes his own noon into the astronomical period by the simple addition or subtraction of his longitude. To introduce any change whatever into the habits of calculation of uneducated men is a slow and difficult process, and is the more difficult when a complex system is to be substituted for a simple one. I am decidedly of the opinion that any attempt to change the form of printing astronomical ephemerides for the use of our navigators would meet with objections so strong that they could not be practically overcome.

"The second conclusion which I wish to consider is that which proposes to reverse our method of assigning algebraic signs to the longitudes by counting east longitudes as plus, and west longitudes as minus. The present system was adopted some forty years ago in Germany as being the most natural, because longitude was measured upon the earth by the apparent motion of the sun and stars from east to west, and it seemed most natural to count the direction of this motion as algebraically positive. This system has been adopted in the American Ephemeris since its origin, and all its tables and formulas which involve the application of longitudes have been constructed on this principle. To reverse this method will cause error and confusion to every one using the Ephemeris without, as far as I can see, the slightest compensating advantages. I am therefore of opinion that it should not be adopted.

"I respectfully submit that in view of these considerations no change should be made in the mode of reckoning time employed in the publications of this office until, by some international arrangement, a common date shall be fixed by all nations for the change."

Prof. Newcomb adds a list of changes in the *American Nautical Almanac* required when the astronomical day is reckoned from midnight.

"Page 1 of each month: The numbers on this page being given for Greenwich apparent noon, the question whether they shall remain unchanged or be given for Greenwich apparent midnight will have to be decided by competent authority.

"Page 2 of each month to correspond with the new mode of reckoning these numbers would be given for mean midnight, which would change the whole page.

"Page 3 of each month: Nearly the same remark applies to these pages as to page 2. When the change is made there will be a discontinuity of half a day in the comparison of the sun's longitudes before and after the change.

"Page 4 to correspond strictly to the new reckoning, the columns noon and midnight on this page would have to be interchanged. This might lead to errors on the part of the computer accustomed to the old system inadvertently forgetting the change which had been made. If not made the system would be a mixed one.

"Pages 5 to 12: All the numbers on these pages will be differently arranged when the hours are counted from midnight.

"Pages 13 to 18: The lunar distances will have to be given for midnight on the first column of the left-hand pages, and for noon on the first column of the right-hand pages, thus reversing the placing of the numbers on the two pages.

"Planetary ephemerides: These will naturally have to be given for midnight instead of noon, and the signification of all the numbers will therefore be different. There will also be a discontinuity of half a day in the progression of the series of epochs at the time the change is made.

"Moon's longitude and latitude: The indications of the times given in this part of the Ephemeris will be altered by half a day. The result would be that a computer inadvertently forgetting the change would take out a result half a day in error.

"Sidereal time of mean noon: Wherever this quantity was given throughout the Ephemeris it would, on the new system, have to be replaced by the sidereal time of mean midnight.

"Transit ephemerides: These would remain unaltered except the column of mean time of transit, which would be changed by 12 hours.

"Changes of nearly the same kind as in the planetary ephemerides would have to be made in giving the predictions of phenomena."

The following extract gives the gist of Commodore Franklin's reply to Prof. Newcomb's objections:—

"So far as the counting of astronomical time from antiquity is concerned, it is the argument of conservatism which desires no change in an existing order of affairs; yet, assenting to this argument, we might refer to a still remoter antiquity—to the time, not of Ptolemy, but of Hipparchus, the 'founder of astronomy,' who reckoned the twenty-four hours from midnight to midnight, just as the Conference has proposed.

"While it is unquestionably true that some confusion may occur, yet the liability to it will be almost entirely with the astronomer, who, through his superior education and training, could easily avoid it by careful attention to the ephemerides he was using. During the years of change, before the ephemerides are constructed in accordance with the new method, it will only be necessary to place at the head of each page of recorded observations the note that the time is reckoned from midnight, to call attention to the fact, and thus obviate the danger of error.

"It is an undeniable fact that the educated navigator finds the conversion of time a simple matter, yet experience has demonstrated that to the mariner who is not possessed of a mathematical educatian there is a decided liability to the confusion which is so greatly deprecated by all who are interested in this subject. I believe that to all navigators, at least to all English-speaking ones, the new method will prove itself decidedly advantageous.

"As is well known, for many years navigators kept sea time, by which the day was considered to begin at noon, preceding the civil day by twelve and the astronomical date by twenty-four hours. The change to civil time now kept on board ship was effected readily and without friction, so that the recommendation of the Conference regarding the commencement of the nautical day has already been largely anticipated. The navigator is concerned not with his longitude but with his Greenwich time, having obtained which he can take from the *Nautical Almanac* the data he seeks whether given for noon or midnight, and when the ephemerides shall have been made to conform to the new system there will be one time in common use by all the world.

"It seems to me eminently proper that the nation which called the Conference should be among the first to adopt its recommendations, and while it might possibly be better to wait until an entire agreement has been entered into by the astronomers of all nations, yet the fact that the first and most conservative observatory in the world has acceded to this proposal of the Conference would seem to be a sufficient reason why we should not wait for further developments. In deference, however, to the views so well advanced by Prof. Newcomb, and in view of the fact that the President has recently transmitted the proceedings of the Conference to Congress, as well also of the desirability of securing uniformity among the astronomers of our own country at least, I have suspended the execution of the order for the present with the view of communicating with those engaged in kindred work in order to ascertain their sentiments on the subject."

The replies received to Commodore Franklin's circular may be summarised as follows:—

Mr. STONE, Leander McCormick Observatory—

Change should be made completely on January 1, 1885.

Prof. NEWTON, Yale College—

Change desirable, may begin at once for internal use, and any communication from an observatory should state precisely what time is adopted.

Prof. PICKERING, Harvard College—

A general agreement more important than the mode of reckoning; will follow Greenwich absolutely.

Mr. HARRINGTON, Ann Arbor—
Will do as Greenwich does.

Prof. HOLDEN, Washburn Observatory—
Begin in 1890.

Prof. YOUNG, Princeton—
Begin January 1, 1885.

Mr. SWIFT, Warner Observatory—
Begin January 1, 1885.

Prof. LANGLEY, Alleghany—
Begin January 1, 1885.

Mr. PORTER, Cincinnati—
Begin January 1, 1885.

Prof. PRITCHETT, Washington University Observatory—
Wait a year at least for general concensus.

Prof. PETERS, Clinton. We extract his letter :—

"I have, from the beginning, attached very little importance to the object and the proceedings of the International Meridian Conference.

"The suggestions and recommendations which have been the result refer principally to things that are already in existence ; for example, the reckoning of geographical longitudes east and west from Greenwich is in practice with most nations. The proposition to count the hours of the day from 0 to 24 also in civil life will scarcely ever be adopted, for nobody (except perhaps sick people lying in bed) will have patience enough to count the striking of the clock up to 24, not to speak of the greater liability of miscounting the strokes and of the difficulty in reading off the turret dial if the circle be divided into twenty-four parts. But what concerns astronomers directly is the change proposed by the Conference in the beginning of the astronomical day, in regard to the introduction of which you ask for my views. It is quite unimportant, of course, whether we begin from noon or from the preceding midnight ; the reasons for taking the former as the starting-point exist no longer. Our clocks nowadays are not regulated, as in former times, by observing the culmination of the sun, and with the telescopes of increased size observations are continued not during the night alone, but are carried on as well in day-time, so that a break in the date at midnight is hardly more grievous than one at noon. While thus we might readily conform with the proposal of the Conference, and put our clocks back by twelve hours, we ought to hesitate nevertheless very much to do so at once, especially for two reasons : First, a general agreement and understanding among astronomers (not of the United States alone but of all nations) should be had ; otherwise it would become necessary for avoiding confusion to add to every observation we publish some such words as 'old-style time' or 'new-style time.' The subject undoubtedly will be discussed in the astronomical periodicals, and in societies representing our science. If authorities such as the Royal Astronomical Society, the German Astronomical Gesellschaft, the larger active observatories, &c., agree in favour of the change, the system of reckoning the astronomical day from midnight will soon be adopted universally. But a partial proceeding seems highly objectionable. Second, if we make a change in the time-keepers of the Observatory now, the use of the astronomical ephemerides, as they lie computed before us, will be made in many respects heavy. Take, for example, the places of the fixed stars, which are given for upper culmination from ten to ten days. When the sidereal day begins before noon, its date in the new arrangement of the solar day is changed. And every star place that we wish to take out of the ephemeris, therefore, requires some additional attention and reflection as to the corresponding date. In the *American Nautical Almanac*, where the tenths of the solar day are given, this inconvenience, to be sure, is not so great ; we need only to diminish our argument by 0·5 day for having that of the table. A similar reduction of the argument must be made in using the lunar ephemeris, and of course in all the data expressed in solar time. In this way a source for at least possible mistakes is opened, and I think it therefore desirable that the change in the *Nautical Almanacs* should *precede* that in the observatories. The *American* as well as the *British Nautical Almanacs* are published as far as 1887, inclusive ; the next or the next two following years may be under preparation.

"These considerations together lead me to the conclusion that it seems *not* advisable to introduce the change in the beginning of the astronomical day *before* the year 1890."

More recently two European astronomers have recorded their opinions. Prof. Struve in a pamphlet,[1] and Prof. Oppolzer in the *Monthly Notices*. The former thus expresses his views :—

"In regard to the change in the beginning of the astronomical day, thinks that the question before astronomers is not only of giving up a long-established custom, with consequent changes of rules of many years' standing, but it also involves a serious interruption of astronomical chronology. Without a doubt the astronomer would have to make a decided sacrifice in conforming to the wish of the Conference ; but, after all, this sacrifice is no greater than our forefathers made when they changed from the Julian to the Gregorian calendar—a sacrifice to convenience of which we are still made sensible whenever we have occasion to go back to early observations.

"We need have little hesitation in making a similar sacrifice if it will prevent discordance between the civil and scientific custom of reckoning time, particularly troublesome where astronomical establishments come in contact with the outer world.

"Prof. Struve states that the Pulkowa Observatory is prepared to adopt the new time, the only question being as to the epoch when the change should be introduced in the publications of the Observatory. He is inclined to recommend that this should be deferred until some agreement can be reached by astronomers, and until the new time is adopted in the Ephemerides. This might be for the year 1890, or perhaps, better still, at the beginning of the next century."

Prof. Oppolzer's opinion is as follows :—

"When once such a universal time is introduced for all purposes it is quite natural that the question must arise, if there is indeed so great a necessity to retain in astronomy, and only in astronomy, a different reckoning of time. I fail to see this necessity, and I do not think that it would cause any serious trouble or confusion if a change were to be made in our astronomical reckoning ; whilst a special mode of reckoning time in one science only, when all others use the generally-adopted standard, will, without doubt, be a source of error and confusion.' He then takes up in some detail the objections urged against the proposed change by Prof. Newcomb, and he discusses the changes which would be necessary in the Ephemerides. Prof. Oppolzer proposes to give practical effect to his views by adopting the new reckoning of time in an extensive list of 8000 solar and 5200 lunar eclipses which he is now preparing for publication."

Science, in an article on this subject, concludes as follows :—

"It is difficult to see how this matter will finally be decided. It is evidently a question for astronomers to settle among themselves ; but so far they seem to be very evenly divided. For instance : out of some twenty-seven astronomers whose opinions, more or less decided, have been accessible for a count, thirteen seem inclined to favour the proposed change, while fourteen are opposed to it. And among the *pros* are Adams, Struve, and Christie ; among the *cons*, Newcomb, Foerster, and Auwers."

MR. FREDERICK SIEMENS'S GAS LAMP

THE illuminating power of the most novel appliances for the production of light having, for economical reasons, been made more and more intense, and therefore more injurious to the eyesight, it follows that the eye must be protected as much as possible from the direct action of the light, with the least possible loss or diminution of effect. In other words, rooms should be lighted only by means of indirect rays or diffused light, the source of light itself not being directly visible. This is, in the author's opinion, a consideration of the highest importance as regards artificial illumination, which has only as yet received partial attention.

Until lately three main points only have been considered in any lighting application—viz. that the apparatus employed should be simple both in its construction and in its use ; that the light should be of sufficient intensity for

[1] "Die Beschlüsse der Washingtoner Meridianconferenz."