the earth or sea may for simplicity's sake be considered as a plane bounded by the circle where the earth and sky seem to meet. This is known as the circle of the horizon. To repre-

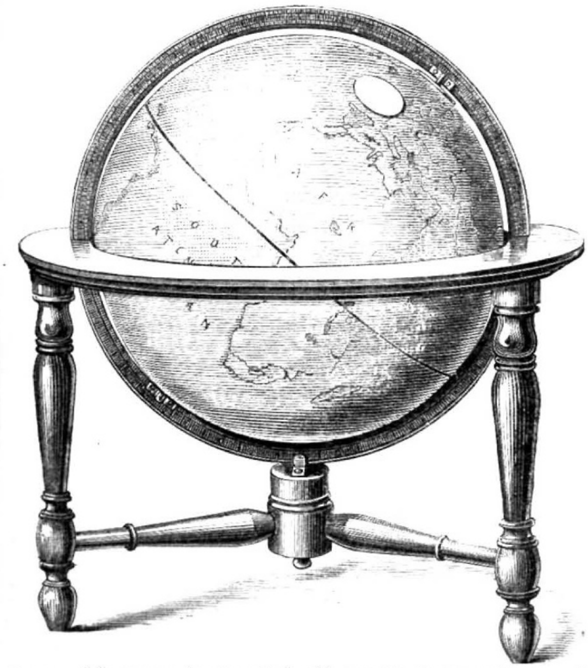

FIG. 24 —Diagram to show how the inclination of the horizon of London will change with the rotation ot he earth.

sent this, a piece of paper may be put over London on our globe (see Fig. 24), and London may be brought to the top. When that has been done, remembering that the stars are placed at so infinite a distance, the horizon which cuts the centre of the

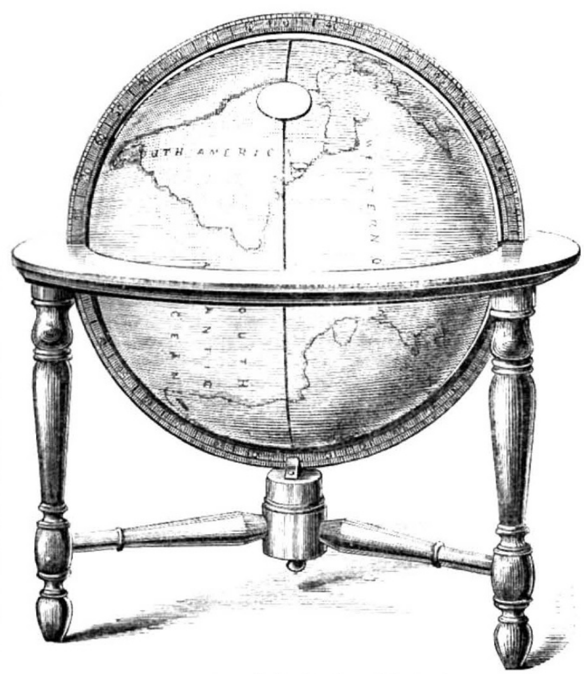

FIG. 25.—Diagram to show how the inclination of the horizon of a place on the equator changes in one direction only.

earth, and which is called the true horizon, may be considered as being practically the same thing as the small sensible horizon of London, represented by our piece of paper, when at the top of the globe, because the two planes will be parallel. For, whether a star be seen from the equator or from London, owing to its tremendous distance it will appear to occupy the same position in space. Now let the globe be made to rotate, then the inclination of the plane of the horizon of any place, of our horizon of London for instance, is continually changing during the rotation (Fig. 24). An exception, however, must be made with regard to the poles of the earth. At these two points the inclination will be constant during the whole of the rotation.

If now a point on the equator be brought to the top of the globe, it will be seen, as the globe is rotated, that the observer's horizon rapidly comes at right angles to its first position (see Fig. 25). This will show that the conditions of observation at different parts of the earth's surface are very different, and this whether it be the earth or the stars which move.

Let us now consider with a little greater detail the conditions which prevail in the latitude of London. Let London be again brought to the top of the globe. Let O (Fig. 26) represent an observer in the middle of the horizon, S W N E. Let Z be the zenith, which, of course, would be reached by a line starting from the centre of the earth, and passing straight up through the middle of the place of observation. S′ is a star, and we want to define its position. How can this be done? Imagine first a line drawn from the observer to the zenith. Imagine next another line going from the observer to the star, or, what is the same thing, from the centre of the earth to the star. Then the angle inclosed by these two lines will give us the angular distance of that star

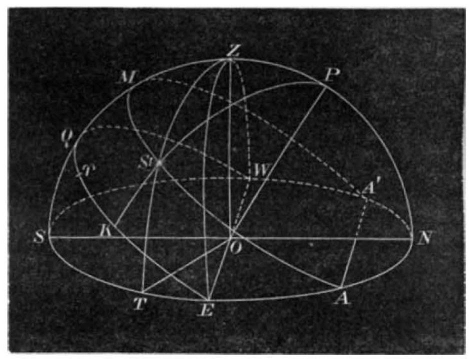

FIG. 26.—Observing condition at London.

from the zenith, or similarly we may take the angle included between imaginary lines joining observer with horizon and star, and thus obtain the star's altitude.

Again, its position may be stated not only with regard to the zenith and to the horizon, but to some other point, say the north point. In that case a line or plane, Z E W, is imagined passing from the zenith through the observer, and the distance between E and N will give the star's angular distance from the north point of the horizon. Again, suppose it be desired to define the star's position with reference, not to the zenith, but with reference to the pole of the heavens, that point where the earth's axis if prolonged into space would cut the skies. In that case since P in our diagram marks the position of the pole, a line P S′ will give what is called the polar distance of the star; and lastly, if the angular distance of the star from the equator of the heavens be required, since the prolongation of P S′ would cut the equator, the distance from S′ to the point of intersection will give the angular distance of the star from the equator; in other words its declination.

We have taken London, but of course each place on the earth has its sphere of observation with its zenith and the north, east, south, and west points. With regard to the axes of the earth and the heavens, they both possess north and south points, and in the heavens as in the earth, the equator lies midway between them.

J. NORMAN LOCKYER

(*To be continued.*)

OUR ASTRONOMICAL COLUMN

THE OBSERVATORY, CHICAGO.—Prof. G. W. Hough has issued his annual Report to the Board of Directors of the Chicago Astronomical Society, detailing the proceedings in the

Dearborn Observatory for 1883. The 18-inch Alvan Clark equatorial has again been employed in close observation of the great red spot and other phenomena of the planet Jupiter. Since the first observations at Chicago in September, 1879, it is stated that the red spot had not changed very materially in length, breadth, outline, or latitude. There had been a slow, retrograde drift in longitude, causing an apparent increase in the time of axial rotation. At the last opposition the deduced mean-rotation period was 9h. 55m. 38·4s. against 9h. 55m. 34·8s. in 1879.

Prof. Hough gives the following mean results of micrometrical measures of the red spot :—

	1879	1880	1881	1882
	"	"	"	"
Length ...	12·25 ...	11·55 ...	11·30 ...	11·83
Breadth ...	3·46 ...	3·54 ...	3·66 ...	3·65
Latitude ...	−6·95 ...	−7·14 ...	−7·40 ...	−7·52

The Chicago observer considers that while the spot has remained nearly stationary in latitude, the south edge of the great equatorial belt has gradually drifted south during the late opposition, until it is nearly coincident with the middle of the spot, and further, that "the two do not blend together, but are entirely distinct and separate." A depression formed in the edge of the belt (as shown in two drawings of the planet's disk, on December 29, 1882, and February 20, 1883), which corresponded in shape with the oval outline of the spot, the distance between the two being about a second of arc. The spot was extremely faint at the last observation for longitude on May 5. The equatorial white spot, first observed in 1879, was again visible during the last opposition; the rotation period 9h. 50m. 9·8s. deduced in the previous year, satisfying the observations.

The great comet of 1882 was micrometrically measured from October 4 to November 20, and sketches of the nucleus and envelope made. Subsequently to October 6 three centres of condensation were usually visible. As the comet receded from the sun, the head increased in length from 25″ on October 4 to 139″ on November 20. As late as March 6 there appeared to be three centres of condensation connected by matter of less density.

Difficult double-stars have been measured by Prof. Hough and Mr. S. W. Burnham, amongst them the interesting binaries, 40 Eridani (Σ 518), β Delphini, δ Equulei, and 85 Pegasi. Measures of the companion of Sirius gave for the epoch 1883.12 position 39°·9, distance 9″·04 ; the distance is diminishing about 0″·3 annually, so that in a few years it will be beyond reach of any except the largest telescopes. With the excellent measures obtained at Chicago more must soon be known as to the period of δ Equulei, reputed the most rapid of all binaries.

TEMPEL'S COMET, 1873 II.—The following are places for Greenwich midnight, deduced from M. Schulhof's elements :—

1883	R.A. h. m. s.	N.P.D. ° ′	Log. distance from Earth	Log. distance from Sun
Nov. 16 ...	18 20 48 ...	113 42·1 ...	0·2867 ..	0·1288
18 ...	18 28 22 ...	113 52·1 ...	0·2877 ...	0·1287
20 ...	18 35 59 ...	114 0·6 ...	0·2888 ...	0·1286
22 ...	18 43 38 ...	114 7·6 ...	0·2900 ...	0·1287
24 ...	18 51 19 ..	114 13·1 ...	0·2912 ...	0·1289

This comet approaches pretty near to the orbit of the planet Mars; in heliocentric longitude 312° (equinox of 1878), corresponding to true anomaly 6°·1, the distance is 0·050.

D'ARREST'S COMET.—M. Leveau's ephemeris of this comet terminates on November 25. The following places are reduced from it to 6h. Greenwich M.T. :—

1883	R.A. h. m. s.	N.P.D. ° ′	Log. dist. from Earth	Intensity of light
Nov. 16 ...	17 15 44 ...	105 13·3 ...	0·3637 ...	0·084
17 ...	17 18 51 ...	105 22·1		
18 ...	17 21 59 ...	105 30·8 ...	0·3628 ...	0·086
19 ...	17 25 8 ...	105 39·3		
20 ...	17 28 19 ...	105 47·7 ...	0·3620 ...	0·087
21 ...	17 31 30 ...	105 55·8		
22 ...	17 34 43 ...	106 3·7 ...	0·3611 ...	0·089
23 ...	17 37 57 ...	106 11·5		
24 ...	17 41 12 ...	106 19.1 ...	0·3603 ...	0·090

M. Leveau mentions that when Prof. Julius Schmidt last observed the comet at Athens in 1870 with a refractor of 0·17m. aperture the intensity of light was 0·150.

On November 16 the comet sets at Greenwich 2h. 10m. af the sun.

The planetary perturbations during the next revolution are r likely to be large, so that in 1890 the comet may be observ under similar conditions to those of 1870.

STANDARD RAILROAD TIME

THE following letter, addressed to our American conte porary *Science*, is of interest :—

Though the subject of standard and uniform railway time h for some years been under consideration by various scientific a practical bodies, it does not appear in any way to have be exhausted, even in its main features. Besides, a certain bi has shown itself in favour of the adoption of a series of certa hourly meridians, and thus keeping Greenwich minutes a seconds, when contrasted with the practicability of a more sim proposition. There is also a feature in the discussion of t subject which bears to have more light thrown upon it : namel what necessary connection there is between the railway compani uniform time and the mean local time of the people, or the tir necessarily used in all transactions of common life. Directly by implication, certain time-reformers evidently aim at a standa time, which shall be alike binding on railway traffic as well as the business community ; and to this great error much of t complexity of the subject is to be attributed, and it has direct retarded the much-needed reform in the time-management our roads.

We say all ordinary business everywhere must for ever be co ducted on local mean solar time, the slight difference betwe apparent and mean time having produced no inconvenience and we may rightly ask the railway companies to give in the time-tables for *public* use, everywhere and always, the mean *loc* time of the departure and of the arrival of trains. It is t departure from this almost self-evident statement, and the su stitution and mixing-up in the time-tables of times referred various local standards, which has in no small measure contr buted to the confusion and perplexity of the present syste The people at large do not care to know by what time-syste any railroad manages its trains, any more than they care wh the steam-pressure is, or what is the number of the locomotiv All the traveller is interested in is regularity and safety travel ; hence it was to be desired that, whatever the standa or standards of time adopted, the companies would refrain fro troubling him with a matter which only concerns their intern organisation, or which is entirely administrative. We loo upon the publication of the railway time-tables, by local tim everywhere, as a *sine quâ non* for the satisfactory settlement the time question, so far as the public at large is concerned ; an it would seem equally plain that the best system for the ad ministration of railroads would be the adoption of a unifor time, this time to be known only to the managers and *employ* of the roads.

We are informed in *Science* of October 12 that the solution the problem of standard railway time is near at hand, an probably has already been consummated by the adoption of fo or more regions, each having uniform minutes and seconds Greenwich time, but the local hour of the middle meridian. T have come down from several dozen of distinct time-systems to very few and uniform ones, except as to the hour, is certainly step forward, and, so far, gratifying ; but why not adopt Gree wich time, pure and simple, and have absolute uniformity Probably this will be felt before long. The counting of twent four hours to the day in the place of twice twelve, and the oblitera tion from time-tables of the obnoxious a.m. and p.m. numbers would seem to be generally acknowledged as an improvemen and simplification, and perhaps can best be dealt with b adopting it at once, accompanied by a simple explanator statement.

C. A. SCHOTT

Washington, October 18

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—No election has yet taken place either for th Professorship of Botany or that of Rural Economy, which ar now separated from each other. The Delegates of the Commo University Fund have agreed to attach a Readership to the Chai of Botany, which will raise the income to 500*l*. a year. Th