discovered. I think it all depends on a person knowing a thing is there ; he can then find it easily.

Mr. Simmons.—I understood from the advertisement when I bought the 3″ telescope that I would be able to see the division, but I may say in spite of all my hopes I failed to see it.

Mr. Raman.—I can safely say that should any one care to have a look through my 2⅜ inch telescope, he would see the line of division between the A and the B rings clearly enough this year.

Chairman.—As far as my experience goes, I think it all depends upon the excellence of the night. You cannot see anything on a night when the sky is muddy and the definition poor, but the point of discussion is that Mr. Raman saw the line of division with a 2⅜ inch refractor and Mr. Simmons was unable to see it with a 3 inch ; I think this was probably due to the state of the atmosphere.

The meeting was adjourned.

The Shifting Ecliptic.

By Mr. Henry Hart.

In these notes it is attempted to explain some effects of the changes which occur in the obliquity of the ecliptic. The angle of the obliquity is not a constant. It is at present diminishing by a calculable fraction in every second of time, being at the rate of ·468 seconds of arc in every year. In the present year, 1913, it is calculated to be 23° 27′ 2·17″ as shown in the Diagram A G, and at the above rate of diminution, the obliquity will entirely disappear in the course of 180,389 years, when the ecliptic will coincide with the celestial equator, and the celestial north pole will be the pole of the ecliptic (Diagram B H). Presuming the procession of the equinoxes continues at the present rate during this period, Polaris will again be the polar star when the ecliptic and the celestial equator are on the same plane, as one

revolution of the circle in the heavens described by the
wandering pole occupies about 25,868 years, and seven
revolutions of that circle will therefore occupy 181,076 years,
which very nearly coincides with the time by which the angle
of obliquity of the ecliptic will disappear.

The effects of this disappearance of the angle of obliquity
will be an entire cessation of the changes of the seasons as
now prevail all over the globe. We have become accustomed
to regard the successive changes from spring to summer,
from summer to autumn, from autumn to winter, and from
winter to spring again, as certain to recur, year after year,
as do the quarter days. Milton, in " Paradise Lost," thus
refers to the obliquity of the ecliptic, giving us the changes
in our seasons, as having been established at the creation to
endure for all time :—

> " Some say He bid His angels turn askance
> The poles of earth twice ten degrees or more
> From the sun's axle ; they with labour pushed
> Oblique the centric globe ; some say the sun
> Was bid turn reins from th' equinoctial road
> Like the distant breadth to Taurus with the sev'n
> Atlantic Sisters, and the Spartan Twins
> Up to the Tropic Crab ; thence down amain
> By Leo and the Virgin, and the Scales
> As deep as Capricorn, to bring in change
> Of seasons to each clime ; else had the spring
> Perpetual smiled on earth with verdant flow'rs
> Equal in days and nights, except to those
> Beyond the polar circles : to them day
> Had unbenighted shown, while the low sun
> To recompense his distance in their sight
> Had rounded still th' horizon, and not known
> Or east or west, which had forbid the snow
> From cold Estotiland, and south as far
> Beneath Magellan."

For some thousands of years before and after the year
182302 A.D. the sun will practically be on the equator day
after day, and year after year, and will never be higher in the
heavens elsewhere than the latitude of the place deducted
from the zenith. Thus, at Calcutta the sun at noon will
always be about 67½ degrees, and at London about 38½ degrees
above the southern horizon ; and, as recorded by Milton,
there will be no night at the poles, where for thousands of
years perpetual winter will prevail. In the temperate zone of
the northern hemisphere, autumn will last through long ages.

The tropics will have no change from the torrid heat of summer, while continuous spring time will prevail in the southern temperate zone.

As time advances after the year 182302 A.D. the ecliptic, continuing its never-ceasing movement in the heavens, will separate from the celestial equator ; and in a further period of 180,389 years, *i.e.*, by A.D. 362691, the present conditions will prevail again ; only what is now winter will then be summer, and summer will be winter ; spring will be autumn and autumn will be spring. (Diagram C I).

A further lapse of 165,765 years will bring the date to A.D. 528456 when the angle of obliquity will have increased to 45 degrees (Diagram D J) and the effects of this will be that all possible variations of climate will prevail in all countries all over the world. Every latitude, at different times of the year, will experience all the changes from arctic cold to equatorial heat. In June the sun will be vertical over the latitude of 45° S. Between July and August it will be directly over the south pole. September will see it back again over 45°S., and it will cross the equator between October and November. Continuing its course northward, it will pass over the north pole between January and February, crossing the equator again at the end of April, and back to 45° S. in June. Such conditions as these, as must have prevailed about 163852 B.C. (Diagram L F) will account for the discoveries of fossils of tropical fauna and flora in the arctic regions.

By the year 874609 A.D. the ecliptic will be increased to its maximum obliquity of 90 degrees from the plane of the celestial equator, in the position shown by E K in the diagram, and by this time the variations in the seasons all over the earth will be excessive. In its orbit round the sun the earth will pass between the sun and the celestial north pole in June, and between the sun and the celestial south pole in December. For five months, from April to August, our north pole will suffer perpetual darkness and arctic cold, while the adjoining latitudes will do so in a less degree. In June (Diagram E) the sun will be directly under our south pole, while in December it will be directly over our north pole (Diagram K). In March and September it will be on the equator, as it is now at the equinoxes.

The subsequent movements of the ecliptic will result in the different conditions already described, being repeated, but with reversals of the seasons. Thus, 1220702 A.D. (Diagram F L) will be similar to 528456 A.D. (Diagram D J). In the year 1386528 the changes in the seasons such as we now enjoy will prevail again (Diagram G A). The other

changes can be followed on the diagram, until we come to the year 2771143 by which time the ecliptic will have completed a perfect revolution, and will be back again in its present position.

These anticipations depend for their fulfilment on the present attractions of the sun and the moon upon the earth being precisely maintained; but whether they will be so or not it would be hazardous to express an opinion, as it seems impossible to foresee what the effects of increasing years will have upon our primary and satellite. We are rather accustomed to look upon present values as fixed values, and the figures above submitted are only intended to indicate the climatic changes which will result if existing conditions continue.

The Diagram.

N. and S. represent the directions of the celestial north and south poles. In the figures of the earth, A to L, which mark its positions in the month of June, n s represent the earth's axis, and ee the equator. The 45 degree parallels of latitude are also shown.

A—G	ecliptic in	1913 and 2771143 A.D.
B—H	,,	,,	182302 A.D.
C—I	,,	,,	362691 A.D.
D—J	,,	,,	528456 A.D.
E—K	,,	,,	874609 A.D.
F—L	,,	,,	1220763 A.D.
G—A	,,	,,	1386528 A.D.
H—B	,,	,,	1556917 A.D.
I—C	,,	,,	1747306 A.D.
J—D	,,	,,	1913071 A.D.
K—E	,,	,,	2259224 A.D.
L—F	,,	,,	2605378 A.D.

and in 163852 B.C.