torial diameter would be 5,700,000,000 of miles. At the moment of projection, it would have the form of a belt or wagon-tire. If this belt extended only one degree each side of the equator, it would be over 49,000,000 of miles in breadth. By the forces of gravity and rotation this belt would soon alter its form, its northern and southern portions would gravitate towards its equatorial centre, where, condensing, it would finally take the shape of a thin ring whose plane would lie in its equator, after the form of Saturn's rings. If this ring were of uniform size and density throughout, and should finally become sufficiently condensed to cohere and form a rigid body, its position would be unstable; the least external disturbance would destroy its equilibrium, and precipitate it upon the parent world revolving within. Should this ring break up and its gaseous materials gather together into a globe, there would still be no provision to prevent the two worlds from rushing together. In throwing off the ring concentric to its own centre, the parent body does not generate any orbit for itself. The breaking up of the ring and the formation of a new globe do not generate an orbitual motion of the parent mass around the common centre of gravity, corresponding to the larger orbit of the smaller body. Hence, the two bodies will approach each other in spiral orbits, until they meet. Therefore, neither globes nor rings, with permanent orbits, can be formed by throwing off rings whose centres of gravity coincide with the centre of gravity of the parent mass.

Let us next inquire how a ring may be projected so as to have the elements of stability within itself. Let the equatorial surface of the primary spheroid be irregular, similar to the irregularities now existing on the sun. It will be remembered that in our sixth lecture we referred to the solar phenomena of immense gaseous waves extending 75,000 miles in length, and of gaseous mountains suddenly arising to the height of 40,000 miles. Let proportional waves and mountains diversify the surface of the primary spheroid. Such waves would be 481,000,000 of miles long, while the proportional gaseous mountains would be over 250,000,000 of miles above the common surface level. If a ring were to be thrown off, including a few small mountains on one side, the common centre of gravity would be at some point in the line, connecting the centre of gravity of the parent orb and the centre of gravity of the ring. Before the ring was detached the axis of rotation would pass through the common centre; but the moment of projection, the axis of rotation in the larger mass is changed to its own centre of gravity which centre of gravity must, by virtue of its previous motion, continue to revolve around the common centre in a small orbit, which orbit must necessarily be in the same plane, and of the same form as the larger orbit described by the centre of gravity of the ring. By knowing the quantity of matter in the two bodies, the exact size of the two orbits can be calculated. If this ring becomes rigid and permanent, the orbits thus generated are a permanent guarantee of the stability of the system.

The exterior ring of Saturn must have been thrown off from his surface, when the planet had at least, an equatorial diameter of 176,418 miles, equal to the exterior diameter of the ring, at which time the average density would be about one-sixth of that of water. The surface of the outer edge of the exterior ring must have had a rotation in 12 hours and 13 minutes, to have lost all weight. But if the planet had had the same proportional increase of density from the surface to the centre which it now has, he would have required 23 hours, 22 minutes, 26 seconds, to have completed one rotation: he therefore must have had a much more rapid increase of density in approaching the centre than at present, to have reduced the period to 12 hours and 13 minutes. If the condensation of the planet near the centre was such as to increase the velocity of the condensing surface in the proportion of the inverse square root of the distance from the centre, this equatorial surface at every instant would continue to be thrown off, until the rate of the condensation became slower, after which the equatorial matter would begin to slightly adhere to Saturn and to contract with him, until he diminished to his present size.

When the ring is first projected, the velocity of every point, from the outer to the inner edge, must vary inversely as the square root of the distance to the centre. But these velocities will be modified as the ring condenses; the exterior portions, adhering to those more interior, will partake of their greater velocity without being again projected; while the portions near the interior edge will adhere to those above them, and thus be retarded, without falling away from the ring towards the planet. And thus, as the ring congeals, there will be a particular circumference where the centripetal and centrifugal force will be equal. All the strata of the ring interior to such circumference has congealed with velocities too small to balance the centripetal force; and all the strata of the ring exterior to such circumference has congealed with velocities too great for the centripetal force. As the ring has become rigid, the exterior and interior edges must rotate in the same period; the exterior portions pulling outwards by its stronger centrifugal force, while the interior is pulling inwards by its superior gravitating force. When these two antagonistic forces become too great for the adherance of the matter, the ring will be circumferentially divided into two or more rings, as is the case with that of Saturn's. But this would take place at a very early stage of its formation, while the adherance was small.

The circumference in Saturn's outer ring which lies between the two antagonistic powers is located 8,285 miles within the exterior edge, and 2,288 miles above the inner edge. The inner portion is the narrowest but very probably is more dense than the outer. The adjustment of quantity and velocity in the two circular portions, is undoubtedly, such as to neutralize the effects of the two opposite powers; for if such were not the case, the ring would be inclined to break transversely; for instance, if the centrifugal force gained the ascendancy, it would produce a rupture outwards; on the other hand, if the centripetal had the ascendance, the rupture would be inwards towards the planet. If the two forces were equal they still might be so great as to divide the ring into two or more rings as we have already observed.

It is very evident that the surface of Saturn, at the time the ring was thrown off could not have been very irregular; that is, there were not any very high gaseous mountains near the equator; if so, the ring would have been too heavily loaded in the neighborhood of those mountains, and the nucleus thus formed would have been a rallying point for all the gravitating matter in the neigboring parts of the ring; and thus a rupture would have been formed, before the ring had time to condense and congeal. Though the nucleus was sufficiently great to generate an orbit of stability, yet it was not powerful enough to rupture the ring by its attractions upon adjacent parts.

If the nucleus is sufficiently great to produce a rupture, such rupture would be the most likely to transpire 180 degrees from the nucleus, on the opposite side of the circumference; for the nucleus would form a rallying point for the matter in the two semi-circular rings, extending on the opposite sides of itself. In the semi-circular ring east of the nucleus, the matter would be retarded in its rotative velocity; while that on the west would be accelerated. The matter on the east, by its decreased velocity and diminished orbit, would finally be drawn into the nucleus on its inner side; that on the west, by its increased velocity and enlarged orbit, would fall upon the nucleus on the exterior or most distant side from the centre. Both of these causes would increase the rotative velocity from west to east.

But a nucleus globe, thus formed of ring-matter could not be maintained in a stable orbit, but must rush to destruction. We have shown how the system is stable before the breaking up of the ring, but when the matter of the ring is broken and the two semi-circular wings are gathered to the nucleus, the conditions necessary to stability are destroyed. For the great mass of the ring when surrounding the central body, does not affect the position of the common centre of gravity; that being affected only by the surplus weight of the nucleus: but the whole matter of the ring may be a hundred or a thousand times heavier than the surplus mass of the loaded part of the ring. Therefore, when gathered in one orb, the common centre of gravity will be removed much nearer the increased mass, and consequently much further from the larger or central mass; hence, the orbit of the smaller mass should be greatly decreased, while the orbit of the larger mass should be correspondingly increased; but the velocities of both bodies remain the same as when the ring was unbroken. The velocity of the larger body is insufficient to describe the required increased orbit, and the velocity of the smaller is to great to describe the required decreased orbit. Therefore, instead of describing balanced orbits either circular or elliptic, each would describe a spiral orbit towards the other, until they rushed together. It must be remembered, that the concentration of the ring materials cannot generate any new orbitual velocities, to preserve the stability of the system. Therefore, the ring theory of La Place and others, to account for the origin of planets and satellites, cannot be sustained. Its impossibility can be mathematically demonstrated.

I shall next proceed to show how planets and satellites may be projected by a condensing rotating gaseous body, without first taking the form of rings. Let the primary spheroid, reaching nearly to the orbit of Neptune, have its equatorial surface agitated the same as the solar surface near his equator is now agitated; that is, let mountains be suddenly elevated and depressed of a proportional size to those on the sun. Such mountains would be many tens of millions of miles in height and breadth, and might contain in a highly rarefied and gaseous form materials enough to form a planet having the same mass as Neptune. Such an immense mountain of gas, when elevated to the present path of Neptune, would by its rotative velocity lose its weight, and become detached from the parent mass. The common centre of gravity between the two bodies would be situated about 151,000 miles from the centre of the larger. The axis of a rotating body must always pass through its centre of gravity. Therefore before the detachment, both the mountain and the centre of the larger mass rotated around the common axis. But as soon as the detachment takes place there will exist three rotations. First, both bodies will continue to rotate (or rather revolve) around the common centre, the same as before the separation. Second, the larger body will rotate around his own centre of gravity with a velocity increasing as he condenses. This second rotation does not in the least interfere with the first, any more than the swift rotation of a top interferes with any slower circular motion which the top may have on a plane surface; Third, the smaller body will rotate on an axis passing through its own centre of gravity, without interfering in the least with its previous revolution around the common centre. Thus the two safety balancing orbits are generated.

Next let us inquire into the form of these orbits. Are they circular or elliptic? Two things are necessary to make the balancing orbits circular. First, the centres of gravity of the two detached masses, at the instant of separation, must not be falling by rapid condensation towards the common centre; if so, they would be detached with a velocity too slow for circular orbits; and as the motion of the centres of gravity of both bodies are in opposite directions and at right angles to the line connecting them, the two points of detachment must be the aphelia of the two balancing orbits. When each has described one-half a revolution around the common centre, they will be on opposite sides of the common centre in the two perihelia points of their safety orbits. During the description of these two semi orbits which would require 82 of our years, the surfaces of both masses would be condensing or drawing nearer to their respective centres; hence, the distances between the surfaces of the two orbs would be increasing. Thus it will easily be perceived that elliptic orbits will result from a detachment of two bodies while they are rapidly condensing or falling towards the common centre. But if detached, when such is not the case, the orbits may be circular.

Second, the two centres of gravity at the time of separation must be in the plane of the equator. When two bodies are separated in the equatorial plane, without being influenced by rapid condensations, their two centres of gravity will move in opposite directions and at right angles to lines drawn perpendiculary to the axis, and with velocities sufficient to balance the gravitating force; therefore their orbits will be circular. But if thrown off while the surfaces are receding towards the common centre, the balancing orbits must be elliptic, notwithstanding they have been projected in the equatorial plane. The seven nearest satellites to Saturn are in his equatorial plane, yet the seven pairs of balancing orbits are undoubtedly elliptic. But these ellipses will have very small eccentricities, owing to the density of Saturn's materials compared with their condition when first projected from the primary solar orb. Such increased density would be likely to prevent very rapid condensations at the time when those seven Satellites were projected. Therefore these orbits must necessarily approximate very near to circles.

Having learned the origin of both circular and elliptic orbits, let us next inquire how they received their inclinations to the primary solar equator. It is evident that all successive bodies thrown off in the equatorial plane, will have no inclinations; and yet we find every planet's orbit inclined to the plane of the solar equator; some more, some less; but none of them have departed only in a very slight degree from that plane. By knowing the present position of the sun's axis and equator, and the present inclinations of the planetary and asteroidal orbits to the ecliptic or the earth's path, we can, by spherical trigonometry, compute the inclination of all these orbits to the plane of the solar equator. Many years since, I performed the laborious calculation for the eight planets and nine of the asteroids. The following table will give the results:

Name of Planet.	*Inclination of Orbits to the Solar Equator.*		
	°	'	"
Mercury	4	14	23.2
Venus	3	58	13.4
Earth	7	20	00.0
Mars	5	51	10.4
Flora	3	41	06.0
Vesta	2	58	22.7
Iris	12	48	15.4
Metis	2	11	42 2
Hebe	12	31	57.2
Astræa	6	39	01.6
Juno	15	00	22.4
Ceres	3	17	07.3
Pallas	35	35	48.6
Jupiter	6	05	51.4
Saturn	5	22	12.1
Uranus	6	33	57.1
Neptune	6	19	41.4

By reference to this table, it will be perceived that the eight planets revolve in planes very nearly coinciding with the plane of the solar equator. The earth which has the greatest obliquity is only 7° 20' inclined to his equator. Four of the nine asteroids approach in their orbits nearer to co-incidence with his equator than any of the planets; another has nearly the same inclination as the four major planets; the other four asteroids have greater inclinations than any of the planets; that of Pallas being over 35°.

How shall we account for these inclinations? For if they were all thrown off from the primary orb in his equatorial plane, they must have since been warped out of that plane; or else the primary orb while condensing from the orbit of Neptune to his present size must have gradually shifted his equatorial plane, or, in other words, the parallelism of his axis. Either of these causes would produce inclinations. But there were no forces in our system to originate either of these effects. Bodies thrown off and revolving in the equatorial plane, could not by their mutual perturbations warp one another out of that plane. Neither could such bodies by their actions on the primary spheroid change in the least the parallelism of his axis. If our moon revolved in the earth's equatorial plane the effects of precession would cease, and the axis of the earth, so far as the moon's action was concerned, would for ever afterwards remain parallel to itself. Any number of moons in that plane would not disturb the earth's axis. So likewise bodies in equatorial orbits around the sun could not originate any inclinations, either of the sun's equator or of their own orbits.

We must, therefore, search for some other cause to account for the inclinations of the planetary and asteroidal orbits. Such a cause exists in connection with their projections. Let us refer to Neptune's inclination to the solar equator. We find by the table that the amount of this planet's inclination is 6° 19' 41".4. Now let one of those vast elevations which we have before spoken of, exist on the surface of the primary orb; and let the centre of gravity of this prominence be located either North or South of his equator at the distance of 6° 19' 41".4 solar latitude. For the sake of simplifying the illustration, we will suppose the centre of gravity of the mountain to be in north latitude from the plane of the solar equator. This immense elevation before its detachment would rotate with the surface, not around the centre of the primary orb, but in a circle whose plane is at right angles to the axis. This plane would be parallel to the equatorial plane, but situated over 156,000,000 of miles north of it. The common centre of gravity between the two undetached masses would be in the equatorial plane; the centre of gravity of the larger mass would be on the opposite side of the common centre from the mountain, at the distance of 151,000 miles. Thus the three centres of gravity would be in the same line. Before the separation of the two masses, let the period of rotation be such that the centre of gravity of the mountain shall have a velocity equal to the aphelion velocity of Neptune in his orbit; let the condensation or the falling of the surface be such that the aphelion velocity will be just sufficient to separate the two masses. The centre of gravity of the detached smaller mass is moving at the moment of separation, not only at right angles to a perpendicular line drawn from it to the axis, but its motion is also at right angles to the line connecting it with the common centre of gravity. And being detached, it will no longer move in its former plane in a circle around the common axis, but it will move in an inclined plane around the common centre of gravity, with an accelerated velocity, until it reaches its perihelion.

Before the separation, the centre of gravity of the larger mass, situated 151,000 miles distant from the common centre, rotated around the common axis in a plane South of the equatorial plane and parallel to it. At the instant of separation, its motion is at right angles, not only to a line drawn from it perpendicularly to the common axis, but also at right angles to the line connecting it with the common centre of gravity. And being free to move, and no longer restrained to rotate around the axis in its former plane, it will be constrained to revolve in an inclined orbit, around the common centre of gravity. Its velocity, at the instant of separation, will have the same ratio to the velocity of the smaller mass, that the mass of the smaller has to the mass of the larger; or, in other words, their velocities are inversely proportional to their masses. Also their motions are in opposite directions and parallel to each other, and at right angles to the line connecting the two masses. And as the velocity of projection of the smaller mass is equal to the aphelion velocity of Neptune, the velocity of the centre of gravity of the larger mass must be equal to the aphelion velocity of its balancing orbit. Thus the two balancing orbits are generated, each being in the same plane, each having the same eccentricity and inclination that Neptune's orbit has, each having the same period of revolution as Neptune, namely about 164½ years.

In a similar manner and precise in accordance with the same law, all the planetary, asteroidal and satellite orbits may have been formed with their eccentricities and inclinations. When the primaries are thrown off, they, in their turn, by increased condensations, and the consequent decreased periods of rotation, throw off with aphelion velocities their respective satellites, each separation generating a pair of balancing orbits absolutely necessary to the stability of its system.

Were it not for the advance or recession of the perihelia, or the exceedingly slow revolution of the elliptic orbits in their own plane, around the common centre of gravity, the present position of the aphelia would point out the solar latitudes and longitudes at which the planetary bodies originated. To solve this problem successfully requires us to ascertain, first, the present longitudes of the ascending and decending nodes on the sun's equator, and the present longitudes of the aphelia on the same equator; and second, to determine the average amount of the annual advance or recession of those nodes on the sun's equator, and the average amount of the annual advance or recession of the aphelia in their own plane. When all of this is determined, the time can also be determined when the aphelia were situated 90° from the nodes; for in this position, and in no other, the respective bodies must have been separated. And thus, not only the latitude and longitude on the primary world at which the projection of each planet occurred, may be determined, but also the times, in ages past, when those great events transpired. All these laborious problems are within the reach of the present state of mathematical science.

In the month of May, 1861, I prepared a series of problems relating to this subject, and forwarded the same to the editor of the *Mathematical Monthly*, published at Cambridge, Mass. But in consequence of the war then pending, the paper ceased its publication, and I heard nothing further from the manuscript. But as it was hastily and somewhat imperfectly prepared, it is perhaps better that it remained unpublished. I shall probably again prepare a new series of problems, or perhaps revise the copy of the old, to be published in connection with this University series, that the attention of mathematicians and astronomers may perhaps be drawn to this department of the science, which, I am fully persuaded, can never be satisfactorily advanced, until these hitherto unexplained phenomena are connected with their causes, and mathematically demonstrated.

REMARK.

Since the delivery of this series of Lectures, Prof. Pratt has carefully and laboriously prepared interesting and valuable Tables, mathematically adapted to his New Theory of the Origin of the Solar System. Should the series be published in book form; these Tables, and the mathematical discussion of the Theory, will be incorporated in the same.

"A PERSONAL MATTER OF IT."

The bleat of one of McKean's calves at Capt. Payne, at the U. P. Depot the other day, about the *Herald* making "trouble" in Salt Lake, was made by the person whose name, title and all, figures in the following extract from the *Cincinnati Commercial*:

"We are informed by a passenger just in from Omaha that on the arrival of Sunday's Pacific train at that place, this same "Colonel" Wickizer rushed up to an Omaha editor on the platform and sent word to a cotemporary editor in the place that unless he stopped publishing news not altogether adverse to the Mormons nor wholly eulogistic of the ring of land-jumpers at Salt Lake, he (Wickizer) would make a personal matter of it. Judging by the way the facts are coming out on the Judiciary and its satellites at Salt Lake, the "Colonel" must fight a large portion of the newspaper press before he can consummate a Norman conquest of the lands, mines and collaterals of the Saints, or raise a war in Utah without a challenge."

This "personal matter of it" was directed at us, but, fortunately for our peace of mind, we never received the hostile message from this redoubtable "Colonel" Wickizer. The suggestion we make is that, to avoid similar accidents hereafter, when this mutton-headed "Colonel" Wickizer has any more messages of the kind to send to us, he bring them himself. This would not only make him sure of their delivery, but it would be such a convenient method of settling "this personal matter of it," you know.—*Omaha Herald.*

Now we do sincerely hope that our energetic and impulsive friends, pro and con, will not get to fighting about us, that is, the "Mormons," for everybody knows that this community are the most peaceable community in the world. Their motto is all the time—Peace on earth, good will to men, not forgetting the women for one moment. "Let us have peace," and, "let brotherly love continue."

THE STAMPING OUT STRUGGLE.

It is impossible not to be filled with uneasiness at the future progress of this struggle, supposing it to be correct that the authorities at Washington are determined to stamp out polygamy. Brigham Young can plead that so far from living in "licentious cohabitation" with sixteen women, they were all his wedded wives, wedded by him under pain of damnation, and that unless he has liberty to comply with the dictates of his faith, the United States is violating its principle of religious toleration. He can raise the banner of persecution, rally round him the thousands of the faithful, and depart, shaking off the dust of his feet as a testimony against the Gentiles, to another country, where he can serve his Creator according to his conscience. Mormon law, so far from sanctioning licentiousness, decrees "Whosoever seduces his neighbor's wife shall die," and travelers assure us that there is not a brothel to be found in Utah. We believe that if "licentious cohabitation," upon which charge Brigham Young is arrested, not for polygamy, is to be treated as an offense punishable by law, a very great number of persons in virtuous New York should be under arrest before the President of the Latter-day Saints was interfered with. Discretion must be used in such cases as the present. It is a great mistake to allow our sympathies to outrun our judgment, or to permit our natural indignation at polygamy to rouse us to a mistaken attempt to suppress it by force.

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Persecution never was the best means for eradicating error, unless it consumed all those holding erroneous opinions.—*Darlington (Eng.) Northern Echo.*