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attached, and the time of its revolution, mathematicians could calcula e the weight of the sun.

However great the disparity apparently existing at first view, between the phenomena, yet upon careful reflection, it is evident, that the centrifugal force generated by the whirling of a stone in a sling, is of the same nature as the centrifugal force generated by a revolving planet around the sun; and as that force can be calculated in the instance of the earth, it is further evident that it can be calculated for the sun; and it is still further evident, that as the centrifugal force in the one instance determines the force of tension of the string, so, in the other instance, it determines the force of gravity, or in other words, the relative amount of matter in the sun, compared with the weight in the sling; and if the weight of matter in the sling be known, the weight of matter in the sun will be known also. I am not aware, that any astronomer ever has calculated the sun's mass, by comparing it with the weight of bodies, attached to whirling strings, yet it is certain that this method is strictly true in theory, and might be resorted to in case we were not in possession of the better method already referred to.

In case our earth were destitute of a moon, the general method adopted by astronomers for determining the mass of the sun, founded on the periodic times and distances of the earth and moon, would be inapplicable and other methods would, doubtless, come into practice.

The weight and bulk of the sun being known, it is an easy matter to calculate its density, and thus arrive at some knowledge of the nature of the materials, as a whole, which enter into its constitution.

If the materials of the sun were as heavy as the materials of the earth, its weight would be much greater than it is now; for we have seen that the sun is about fourteen hundred thousand times larger than the earth, while it is only about 360,000 times heavier; consequently, if there should be taken a volume of matter from the sun, equal in bulk to our earth, it would weigh only about ¼ as much as the earth.

If the materials of the sun were as heavy as the materials of our globe, instead of the sun's weighing only 360,000 times as much, it would necessarily weigh as much more than the earth, as it is greater in bulk. The density of the sun is a little over 1¼ times the density of water; that is, if about 1,750,-000 globes of water, each equal in size to the earth, were moulded into one, the united mass would weigh as much as the sun.

Having ascertained that the average density of the sun is but a trifle greater than water, let us next inquire, What is the relative weight of the materials on its surface?

Perhaps some of this audience may be startled when they are informed that the astronomer can not only weigh the sun and give its average density as a whole, but can also give the relative weight of the materials at its surface.

The solution of this problem was achieved by the discovery of the law of force which obtain between the particles of matter of which the worlds are made.

This law may be expressed as follows: Every particle of such matter has a tendency to approach every other particle with a force directly proportional to their respective masses, and inversely as the squares of the distances between them.

If the distances are equal, the approaching tendency is directly proportional to the masses towards which a particle gravitates, that is, one-half, one-third, one-fourth, or one-tenth the mass, will generate one-half, one-third, one-fourth, or one-tenth the force called weight.

But when the distances are unequal, these direct ratios of the masses must be multiplied by the inverse squares of the distance. These are the laws of particles. The same law holds good in the gravitation of particles to large masses in the form of spheres.

It can be demonstrated geometrically, that the gravitation to the surface of a sphere is precisely the same as if all the matter of the sphere were collected in its centre.

Now suppose that all the matter of the sun and earth was collected in their respective centres, what would be the gravitating tendency of bodies at the distances of their respective semi-diameters, namely 440,000 and 4,000 miles?

The earth is 1-360,000th part of the mass of the sun; therefore, at equal distances, bodies would have 360,000 times greater weight or tendency towards the centre of the sun than what they would have towards the centre of the earth; but as gravitation diminishes as the square of the distance increases, and as the surface of the sun is about 110 times as far from its centre, as what the surface of the earth is from its centre, it follows that the intensity of gravity, resulting from the consideration of the relative masses, must be diminished in the ratio of the square of 110 to 1, or in the ratio of 12,100 to 1.

Therefore if 360,000 be divided by 12,100 the quotient will be 29. 7.

Hence bodies at the surface of the sun are nearly 30 times heavier than at the surface of the earth.

If the above data had been taken in their true numerical value, instead of round numbers, the result would be 27. 9; tnat is 1 lb. of terrestrial matter would, if carried to the surface of the sun, weigh 27. 9 lbs.

An ordinary man who would weigh on the earth 160 lbs., would, if transported to the surface of the sun, weigh 4464 lbs., and therefore would literally crush to pieces under his own weight.

If the surface of the sun be composed of materials heavier than its mean density, that is, if the specific gravity of the surface strata be more than 1¼ times that of water, then the density will be uniform from the surface to the centre; if the specifie gravity be less than 1¼ that of water, then the density will increase from the surface to the centre.

Has the sun an axial rotation, or is it at rest, is a question frequently asked by the inquisitive mind of man. We have already shown in our former lectures, that the apparent diurnal and annual revolutions of the sun are not equal, but arise from the real motions of the earth upon its axis, and in its orbit. So far as we have been able to extend our observations, the planetary bodies of this system have a rotation upon an axis; this seems to be indispensibly necessary, in order that different sides of those bodies may alternately be exposed to the heat and light of the sun. But the sun being the great source of heat and light, does not apparently stand in need of either heat or light from any external source; and therefore, it would seem altogether unnecessary for it to have a rotation upon an axis; if no beneficial object is perceived to result from a rotation of the sun, we might be led to conclude, in the absence of any direct evidence, that the sun was really quiescent in the centre of the system.

But when we examine the sun by the aid of a telescope, we discover upon its disc many large spots which appear dark, and when watched from day to day, they appear to move across the disc from east to west.

When first discovered near the eastern limb, their velocity is very slow, but increases as they approach the middle of their paths, at which place, the velocity arrives at its maximum value, after which the velocity gradually decreases until near the western limb, when the spots disappear and remain invisible some twelve or thirteen days, and then again re-appear near the eastern limb, describing the same paths as before.

Were these appearances produced by dark bodies intervening between the earth and sun, having an orbitual motion independent of that luminary, then the velocity would be uniform; but the variable velocity, observed in the description of their apparent paths, is precisely the same as it would be if those spots were a part of the surface of the sun itself, rotating upon an axis from west to east. With such a rotation, it is eivdent that the side of the sun turned towards the earth would have a movement apparently from east to west; while the most distant hemisphere which is turned from us, and consequently invisible, would have a motion from west to east.

If these spots apertain to the surface of the sun, they will each describe a circle parallel to the sun's equator; and if this equator were coincident with the plane of the ecliptic, each of these circles would at all times appear like straight lines on the sun's disc; but if the plane of the sun's equator be inclined to the plane of the ecliptic, the circles described by these spots will, by the effect of perspective, appear elliptic.

One-half of the year these apparent semi-ellipses will present their convex sides towards the upper limb of the sun, and the other half of the year their convexity will be presented towards the lower limb. These appearances are produced by the relative positions of the sun's axis to the earth in different points of its orbit. These ellipses will, at certain seasons of the year, appear much more elongated than at other seasons; this also depends upon the relative position of the axis of the sun to the earth in different portions of its orbit.

There are two days in a year when the axis of the sun is at right angles to the line of vision, namely, the 11th of June and the 12th of December. At these two periods the spots on the sun appear to describe straight lines. After the 12th of December, the apparent paths of the spots begin to deviate from a straight line, the convexity being towards the north, or towards the upper limb of the sun. This deviation from a straight line will continue to increase more and more, until the 10th of March, when it will attain to its greatest value.

From the 10th of March, the curvature of these ellipses will begin to decrease, and continue decreasing until the 11th of June, when the spots will again apparently describe a straight line; after which they will again deviate, but in a contrary direction, the convexity being towards the south, or in other words, the sun's lower limb; the curvature will increase more and more, until the 13th of September, when it will become greatest; then again receding until the 12th of December, when their apparent paths will again be straight lines.

Thus it will be seen that on the 12th of December the earth passes from the northern to the southern side of the plane on the sun's equator; while a spot on the sun's equator, at the same time, appears to ascend from the southern to the northern side of the plane of the ecliptic; this is called the ascending node of the sun's equator. The heliocentric longitude of the ascending node is 80° 21′. On the 11th of June, the earth passes from the southern to the northern side of the plane of the sun's equator, while a spot on that equator appears to descend from the northern to the southern side of the plane of the ecliptic; this is called the descending node of the sun's equator, and is situated directly opposite the other node, 180° further east. The descending node, therefore, lies 260° 21′ heliocentric longitude.

If the shorter semi-axis of these elliptic paths be accurately measured with a micrometer—say, for instance, when the earth is 90° distant from either of the aforementioned nodes, or on the 10th of March, or 13th of September—it will be an easy matter to determine from these measurements the inclination of the plane of the sun's equator to the plane of the ecliptic; this is found to be about 7° 20′, and the period of rotation, 25 days, 7 hours and 48 minutes. This period does not bring the same spots into the same relative position, in regard to the sun and the earth, that they occupied at the commencement of such period; for the earth, during this period, advances in its orbit over a space equal to about 1-14 part of the whole circumference; consequently the sun has to perform more than one complete rotation before the same spots are brought round to the same relative position that they occupied at the commencement of the period; this period, which may be termed the apparent period, is two days longer than the real period of the rotation.

The distance around the sun being about 2,790,000 miles, a spot on the sun's equator must move with a velocity of about 4,589 miles per hour; this is over four times swifter than the earth's equator moves by its rotation.

The rotation of the sun generates a centrifugal force at its equator about 1-6 of the centrifugal force generated at the equator of the earth by its rotation.

In a former lecture, we proved that the centrifugal force at the earth's equator is about 1-289 part of the earth's gravity; hence, the centrifugal force at the sun's equator is only about one sixth of this fraction, or 1-1734 part of the earth's gravity; but in this lecture we have proved that the earth's gravity is 27.9 times less than the sun,s gravity.

Therefore, the centrifugal force at the sun's equator is 1-48379 part of the sun's gravity.

A body will fall at the sun's equator about 5375 4-9 inches in a second, and if the sun had no rotation, it would fall about 1-9 of an inch further.

A clock pendulum which will vibrate seconds here on the earth would if carried to the surface of the sun, vibrate over five times more rapidly; that is, a pendulum of the same length would make 5282 vibrations at the surface of the sun at the same time that it would make 1,000 vibrations at the surface of the earth.

If the sun's rotatory velocity should becoms about 219 times more rapid than it is at the present, bodies would have no weight at the sun'e equator, and a complete rotation would be accomplished in about 2 hours and 46 minutes.

It is probable that the sun is not a perfect sphere as it would be had it no rotation, but its deviation from the spherical form is very much less than that of the earth; for the centrifugal force of the sun's equator, compared with the force of gravity at his surface, is 167 times less than the centrifugal force of the earth's equator, compared with the force of gravity at its surface. Therefore, the force exerted to alter the spherical form of the sun is 167 times less than the force exerted upon the earth to alter its spherical form. Hence the spheroidal form of the earth is much more oblate than that of the sun.

If the mathematical students in the University, will solve these astronomical problems for themselves, it will have a tendency to make a more lasting impression upon their minds, and will make them more familiar with the grand mechanical forces of the universe, and will raise their thoughts to heights still more sublime—to glories still more resplendant—to powers Omnipotent, enthroned in everlasting light, creating, upholding and governing all things.

AGRICULTURE.

THERE are many methods in vogue for curing hams, but it hardly matters which is adopted, nor how much care is given in the process, it is a very common occurrence for them to spoil, through the salt or saltpetre failing to strike in the joint. Whenever this is the case, though the meat may keep sweet and wholesome in cold weather, it is sure to heat and become unwholesome on the approach of summer. How to avoid this in every case is an item of knowledge that would be of great worth, and as a means of doing so has been imparted to us by a gentleman residing in this city who has had a great deal of experience in curing pork in England, we propose to give it through the NEWS for the benefit of our readers. It is simply, before salting, or a day or two after, to break the thigh joint, thus giving egress to the joint oil, the retention of which prevents the salt striking and spoils the meat. This is very easily done, and we are assured by our informant that its efficacy is never-failing.

Bro. James McBride, of Grantsville, Tooele Co., a farmer of Utah, has done better, he informs us, in raising barley, than the farmer did on the Isle of Man, whose yield we mentioned last week. He says: "In three years I raised fifty-five bushels of barley from a single grain, and this was raised the third year on three-quarters of an acre of land. This was the six-rowed barley. My crop would have been much more but I lost three heads of about seventy-five kernels each from the first yield."

Mrs. Millington, of England, to whom was awarded last year the Royal Agricultural Society's prize for the best managed farm, (the profit of the business being the chief test in the competition), spends $6,000 a year for cattle food—most of it linseed cake from America—the consumption of which on her farm secures an abundant supply of good manure, by which she raises large and profitable crops from a poor, light soil. This is the sy tem of "high farming" which just now is finding favor with thinsing, shrewd farmers in the United States. They discard the old style of not keeping more stock than they can raise food to support; and keep all the stock they can properly shelter, and for which they can get money to buy food. It may be that in some parts of this Territory farmers can not adopt this system of "high farming;" but the rapid changes which are being effected in this city and neighborhood by the railroad and other causes, will soon make it profitable for our farmers to pursue this system. It will pay now to keep stock up and feed it, and also to make manure in quantities to supply the annual waste which results from constant cropping. The day we hope has passed when farmers will think that it is not necessary to restore the elements to the land which they have taken from it in the shape of crops. Nature keeps as strict an account with those who cultivate the soil for her treasures as any banker or merchant can do with his customers. If they continue to draw from her and never make re-payments, some day not far distant they will find their credit exhausted, and her rich stores locked up beyond their reach.

A correspondent of the Massachusetts *Ploughman* has been testing pigs of the Berkshire and White Chester varieties side by side, to find out which is the best breed. His two lots of pigs were selected from the best breeds of each, and were fed separately with the same food, and both lots were fed all they could eat without leaving or wasting food. The following is his report of the results:

The Berkshires were thoroughly fatted and killed at two hundred days old, weighing two hundred and forty pounds and two hundred and fifty pounds respectively, making a gain of one and one-fifth pounds for each day's existenoe.

The White Chesters were killed at two hundred and forty-nine days old, weighing two hundred and seventy-five and three hundred pounds respectively, making a gain of one and one-sixth pounds for each day's existence.

His conclusions are that for one's own use and for home consumption, where average weight, and where sweetness or fineness of grain or texture is desirable, where one wishes to mature the quickest with the same amount of food in a given time, he knows of no established breed more desirable than the Berkshire; but for heavy pork for shipping purposes, he knows of no better among the large breeds where fair returns are to be realized than from the White Chester.

A WRITER in the *American Agriculturist* attributes the increase of weevil and other grain-destroying insects to the neglect of proper manuring. Weevil, he says, is another name for weak plants, and weak plants mean a weak soil. The farmers of the East, he continues, begin to see it now, and many a man is straining every nerve to replace the fertility that his ancestors have allowed to go to waste. He closes this subject by saying that it is easier to keep land rich than to make it rich, and infinitely cheaper too.

The same writer gives a recipe for coloring winter butter. It consists simply in grating a few perfectly clean, deep-colored carrots, and squeezing the juice into the churn with the cream before the churning commences. He uses for each churning (of about 20 lbs.) a dozen medium sized carrots; and that quantity makes color enough for winter.

In feeding cows carrots he gives from a peck to a half bushel daily to each milking animal. Ruta-baga turnips and mangels frequently affect the taste of the milk and butter—the turnips being much the worse of the two. All difficulty on this score may be avoided by feeding only at milking time, or immediately thereafter. Turnips fed in the morning will not be tasted in the evening's milk, while if fed at noon they will be. Even when fed, as directed, too much must not be given at once, say not more than a peck at each milking time.

POINTS OF A GOOD COW.—She's long in the face, fine in her horn; she'll quickly get fat with cake or corn; she' slean in her jaw and full in her chin; she's heavy in flank and wide in loin; she's broad in her rib and long in her rump—a straight and flat back, with never a lump; she's wide in her hips and calm in her eyes, slender in neck and heavy in thighs; she's fine in her breast and good at the pail, udder well forward and slim in the tail; she's fine in bone and silky of skin; she's a grazier's without a butcher's within.