The Deseret News.
TRUTH AND LIBERTY.

GEORGE Q CANNON.....EDITOR

Wednesday, ...Jan. 25, 1871.

danger of falling away from it. Next we shall proceed to investigate the grand and important question, whether the earth be at rest or in motion.

It is evident that we can never make any considerable advance in astronomy, until this question is determined. We perceive nothing in the constitution of the earth which disqualifies it for motion.. Its shape and magnitude can be no obstacle; the qualities and proportions of its various elements and compounds do not render it immovable; the atmosphere by which it is enveloped, and the internal forces within, do not affect its mobility in the least. If the spaces surrounding the earth on all sides be comparatively empty and void of substance, there can be no external resistance offered to its motions. Under such circumstances the earth must be free to yield to the slightest pressure or impulse from without; and the result of such pressure or impulse would necessarily be motion, however feeble and imperceptable to us.

It is impossible for us to judge whether the earth be at rest or in motion by our feelings. When a ship is becalmed on a smooth sea, it will frequently swing round so as to head in different directions; no one would be sensible of this rotation without reference to the compass or some external object; no one has felt any rotatory motion. If the ship were wafted along by unknown currents at the rate of 5 miles per hour, no one would perceive the motion, but might fancy themselves at rest, until by an observation on the heavenly bodies, they detected such motion. A person in a balloon, if wafted by a heavy, yet steady gale, at the rate of 60 miles an hour, would feel no motion of the wind, and might suppose himself at perfect rest in a calm, until by reference to the surface of the earth, he perceives his great velocity. The earth, with all it contains, might fly in space with any conceivable volicity, however great, and no one upon its surface would know whether he were at rest or in motion, unless by a reference to external objects. The earth might have a rotatory movement upon an axis unperceived by us, and which conld only be detected by the most careful observation and experiments.

As a man passing down a river, carried by a swift smooth current, would be obliged to refer to the shore to determine whether he were in motion, so a man who would satisfy himself whether the earth be in motion, must refer to objects in the heavens, unconnected with the earth; if the heavenly bodies constantly shift their position in regard to the earth, he is forced to conclude that either the heavenly bodies themselves are in real motion, or else, if they are stationary, that the earth must be in motion; or, if both be in motion, that the phenomenon is the result of their relative motions; hence, it is not easy to conclude from such observations alone, whether it be the earth or the heavens that are really in motion.

By referring to the starry heavens above us, we see them apparently in motion from east to west. Let any one who wishes to behold this magnificent scenery and become acquainted with the apparent motions of the stars, station himself on some clear evening in a convenient position facing the south; let him fix his attention upon those stars which are near the southern horizon, and he will preceive that they will not remain long above the horizon; they arise just east of the point where the meridian cuts the southern horizon, ascend gradually to the meridian where they attain their greatest altitude, and then gradually descend, and finally set at a small angular distance west of the meridian. During the short time of their visibility, they appear to describe only the small upper segments of their diurnal circles.

Let him next turn his attention to that quarter of the horizon between the south and east, and he will behold a succession of stars and clusters of stars, rising one after another, as if they came out of the earth at different points along the horizon; the further their rising point is from the south, the larger will be the segments of their circles which they will describe above the horizon, and the greater will be the length of time that they will remain in sight. Each star will attain its greatest altitude on the meridian, and will set precisely as many degrees to the westward of south as they rose to the eastward. Those stars that rise exactly in the east, will set exactly in the west, and will describe semi-circles nearly in twelve hours.

Next, let him carefully observe those stars which rise between the east and north east points of the horizon, and he will find that they remain above the horizon more than twelve hours; that the various segments which they describe are greater than semi-circles, and that they descend behind the western horizon as far to the north of west as they rose north of east. Those stars which come to the meridian directly over our heads, and whose zenith distance does not exceed nine degrees north, will remain above the horizon nearly twenty-four hours, and their visible diurnal arcs will be nearly the whole circumferences of circles; they will sink below the edge of the horizon a little to the west of north, behind which they will remain only for a few minutes and then they will rise again as far on the east of north, as they set on the west; while all the balance of the stars in the northern regions will appear to describe entire circles around one point in the heavens, called the *Pole*. This polar point is on our northern meridian, and is elevated obove the north point of our horizon, about 40¾ degrees, being the same as the latitude of our city. All the heavenly bodies within 40¾ degrees of this polar point never rise or set to us. In describing their diurnal circles, they come to the meridian twice at equal angular distances from the pole, at which times they are due north of us. They approach the upper meridian from the east, and then gradually descend in semi-circles and apparently approach the lower meridian from the west, at which point they begin again to ascend in the semi-diurnal arcs which are on the east of the meridian, until they again attain their greatest altitude on the upper meridian. The polar point seems to be the only one in our northern sky but what is in apparent motion. This point is not marked by any star, but is purely an imaginary immovable centre. A bright star, called the Pole Star, is situated about one and a half degrees from this centre, and describes a very small circle around it, in the same time and in the same manner as the rest. The diurnal circles of the stars seem to diminish or become smaller in proportion to their distance either north or south of the equinoctial plane. From these appearances we may reasonably expect that there is another pole of the heavens in the south, situated directly opposite the north pole, being as much depressed below the southern horizon as our pole is elevated above the northern.

Let any one who wishes to satisfy himself upon this subject by observation, travel to the south; and as he proceeds towards the equator, he will behold the stars which are just above the northern horizon begin to sink below it; while new stars which perform their diurnal circles below the southern horizon will be brought into view. When he has arrived at the equator, he will perceive all the stars of the firmament, both in the north and in the south, describing semi-circles, and remaining nearly 12 hours above the horizon. When he arrives at the same distance south of the equator that we are north, he will observe a point in the heavens, elevated 40¾ degrees above the southern horizon, around which all the heavenly bodies in the southern regions, circulate from east to west, exhibiting all the phenomena manifested in our northern regions, as seen in this latitude. This point is called the *South Pole* of the heavens. If he turns his eyes to the north, he will find that our north pole, and all the circumpolar stars have sunk beneath the horizon, and will no more in that latitude, render themselves visible.

The stars that now pass over our heads will rise and remain a few minutes above the horizon, and then set below it. All the heavenly bodies north of the equatorial circle will present the same phenomena to him, that those south of that circle do to us; and all the stars in the southern hemisphere will exhibit to him the same appearances in their apparent notions that those in the northern hemisphere do to us.

All the heavenly bodies which we see set behind the western horizon, will pass under the earth and rise again in the east. If any one will have patience to watch the stars, during a long winter's night, he will in the morning behold the same stars rising in the east which he saw, early in the evening, setting in the west: and the upper and lower hemispheres of the heavens will be gradually and successively brought to his view. The precise time in which every star performs its apparent diurnal revolution around the earth is 23 hours, 56 minutes, and four seconds. This is called a sidereal day, and is 3 minutes and 56 seconds shorter than a mean solar day. The cause of this difference we shall hereafter explain.

Our earth seems to be at rest, while the starry sphere, enclosing us, seems to rotate around us from east to west; but if we suppose the stars to be at rest, and the earth to rotate upon an exis from west to east, all the phenomena which we have described, will take place in the same order and in the same time. These phenomena, therefore, when considered alone, do not determine, whether it is our globe or the starry sphere that is in rotation. One or the other it *must* be.

The grand object which the Almighty had in view in producing these diurnal movements, was the alternate succession of day and night. This important end could be obtained by a simple rotation of the earth upon its axis, instead of causing the sun and innumerable other worlds to revolve around us. The planet jupiter, though fourteen hundred times larger than the earth, moves around its own axis in a little less than ten hours. Saturn is nearly a thousand times larger than the earth, yet it turns on its own axis once in ten hours and a half. The inhabitants upon the surfaces of these planets will see the starry heavens apparently revolving around them in a different position and with more than twice the velocity that they appear to have round the surface of our earth. If not informed to the contrary, they might suppose that the motion of the sun and stars around their axes was real; whereas we know from observation that the succession of day and night upon those planets is produced by their own rotations. If, then, day and night upon other planets is caused by their own rotation, why may not our day and night be occasioned in the same manner? Is it reasonable to suppose that our globe is an exception to the general law of rotation which we know obtains in many of the other planets? If the magnitude of our globe be an objection to its rotation, then the magnitudes of Jupiter and Saturn, which are a thousand times larger, would be a far greater objection to their motions. If any one suppose that the earth must not move because of its magnitude, let him turn his attention to the sun, which is about 1,400,000 times larger than the earth, and yet he turns around upon his own axis in about twenty-six of our days.

Moreover if the earth has no diurnal motion, that vast luminary must fly around us every 24 hours, performing a revolution of 597,000,000 of miles every day; and all this merely to accommodate the inhabitants of our little globe with the blessings of day and night. No wisdom would be displayed in such an arrangement of things. When we stand before a fire and wish to warm different sides of ourselves, how shall we the most easily accomplish it? It can be done in two ways: by attaching a piece of machinery to the chimney and moving the fire place, fire and all, around us, we may be equally and alternately warmed on different sides: but how much more simple would it be to merely turn round ourselves, and let the chimney and fire-place remain stationary? The rotation of the earth, therefore, in order to experience the benefits of the heat and light of the sun on its different sides, is infinitely more simple, and displays infinitely more wisdom than to suppose a revolution of that vast body around us.

Another presumptive argument against the diurnal movements of the heavens being *real*, is that the sun, moon, and stars have nearly the same period of revolution, though they are bodies of different magnitudes, and are placed at different distances. The sun is 400 times farther from us than the moon. Saturn is about nine times the sun's distance from us. The planet Neptune is more than a thousand million of miles beyond Uranus. The nearest fixed stars are 10,000 times further off than Neptune. And many of the telescopic stars must be, at least, 1000 times more distant than those seen with the naked eye. The most of these bodies, and probably all, differ, not only in their distances. but in their magnitudes. Now how is it possible for us to conceive all these bodies to revolve around our globe in the short period of twenty-four hours? Why should they all have about the same period when they differ so immensely in their distances? Why should the sun travel 400 times faster than the moon? Why should the planet Neptune travel thirty times faster than the sun? Or why should the nearest fixed stars fly 10,000 times swifter than Neptune? Can we for a moment believe that there are bodies in the universe that fly 800,000,000,000 times swifter than light, without accomplishing any useful purpose whatever by their inconceivable velocities? All these impossibilities must exist, if we admit the apparent diurnal motions of the stars to be real. These arguments if not demonstrative, carry with them an irresistable conviction that the diurnal motion must be referred to the earth and not to the heavens.

It is a principle of mechanics, founded on the laws of motion, that the more distant a body is from a central gravitating force, around which it revolves, the less will be its orbitual velocity, and the greater will be its period of revolution. Under the present laws of gravitation, all bodies which do really revolve around the earth *must* have velocities which vary according to the inverse square roots of their distances: that is, bodies situated from us 4 times the distance of the moon, will have only ½ the velocity that the moon has; because that ½ is the inverse square root of 4; those which are 9 times further from us than the moon, will have only ⅓ of her velocity; 16 times the distance, will give ¼ the velocity; 100 times the distance, one-tenth the velocity. The distance of the sun being 400 times greater than that of the moon would require only a velocity of one-twentieth of that of the moon's, in order to balance the centripetal force of the earth gravitation: consequently if the sun and moon's apparent diurnal motions be admitted as *real*, he would have a velocity 8,000 times too great for the earth's gravitation, in order to get round the earth as soon as the moon. Hence the sun's diurnal period, compared with that of the moon's, would be 8,000 times shorter than it should be, according to the known mathematical principles of mechanics. But even the moon's diurnal period, if performed in one day, is about 27⅓ times too quick to balance the centripetal force of the earth's gravitation; and therefore the sun's true period, compared with the moon's true period, would be 27⅓ times 8,000, or more exactly, 218,572 days, which, reduced to years, would be 598 years and 302 days. The intensity of gravitation at the earth's surface has been determined by experiment: and knowing the earth's radius, it is a simple problem in mechanics to calculate the period which a body must have to revolve around the earth near its surface without falling; this would be 83 minutes and 22 seconds. Now, if gravity is a force which varies inverely as the square of the distance, (as it may easily be proved to be,) then it may easily be calculated how far all bodies must be placed from the centre of the earth, in order to have their periods equal to the diurnal period of the stars; this distance is only 26,680 miles: and none of the heavenly bodies. must be placed any nearer or further off than this; if so, their periods would be less or greater than one day: and as it is known that none of them are placed at that distance, we know that their apparent diurnal periods are not *real*. This, then, is a demonstration of the diurnal rotation of the earth to all persons who are capable of solving these mechanical problems.

Another demonstrative evidence that the earth has a diurnal motion may be obtained from experiment. Let a ball be droppe dfrom the top of a high tower or precipice; if th eearth has no rotation, it will fall perpendicular.y to the surface of the earth; but if it has a rotation from west to east, it will fall a short distance to the east of the perpendicular line at the foot of the tower. This is occasioned by the unequal velocities of the bottom and top of the tower resulting from the earth's rotation; for instance, the bottom of a tower or perpendicular precipice one-half of a mile high, situated on the equator, and being nearer the centre of motion than the top, would move slower than the top, which is half a mile further from the axis. The time of falling would be about 13 seconds, during which time the top of the tower or precipice would describe an arc about 2¼ inches longer than the arc described by the bottom; and the ball partaking of this velocity, when it first leaves the top, will fall about 2½ inches east of the foot of the perpendicular line. The greater the height from which it falls the greater will be its deviation from the perpendicular. Experiments of this nature have been performed with the greatest accuracy, and the results have proved, beyond all controversy, that the earth really has a diurnal rotation from west to east.

This grand fact has also been demonstrated by pendulum experiments in different latitudes; but time will not permit, in this lecture, to examine the curious and most remarkable phenomena resulting f rom this species of evidence.

Bishop Wm. Price, of Newton, called upon us this morning and from him we learn of the progress which is being made in that quarter by the people. Like many other places, Newton has suffered severely from ravages of grasshoppers. It is thought that they laid some eggs there this last Fall, but it is hoped and generally thought that they were not very numerous. The good land of the settlement not being in one body, the settlers cannot farm and fight the grasshoppers with that success which residents of other places do who have good land in abundance in a compact body. The people contemplate fencing several hundred acres of farming land on the north of their settlement, which they think will be good for cultivation; and the prospects for the coming season they think rather favorable. A co-operative sheep-herd was organized at Newton this last Fall, to which the citizens of other settlements have sent their sheep, the range in that vicinity being the best in the county.

From Bishop Price we gain the gratifying intelligence that the Bishops of Utah county met on Friday afternoon last, at Provo city, as a committee to adopt measures for the formation of co-operative herds of cattle, horses and sheep. The subject was mooted at the regular Bishops' meeting four weeks previously, and the Bishops of each settlement were appointed a committee to take the subject under consideration. On Friday an organization was effected by the nomination of Bishop M. Tanner, of Provo, as President of the Utah county cattle, horses and sheep Co-operative Herds, (Bishop A. O. Smoot nominating him), he himself having so many other duties to attend to that he could not accept the position of President) and Bishop W. Bringhurst, of Springville, as Vice-President. A director was also nominated for each settlement in the county. Brother Chipman, of American Fork, and Brother Tanner, of Payson, were proposed as Superintendents of the Herds. They will take the general charge of the stock, of its removal, will select suitable herd grounds, hire herdsmen, and attend to all other business connected with the management and care of the stock. It was also suggested to have a farm in connection, so as to raise the necessary feed for the stock. Another meeting has been appointed for the first Monday in March to perfect arrangements.

It is felt that the formation of these co-operative herds will be attended with the happiest results. There is one excellent effect, to which Bishop Price alluded, that will follow this organization, namely, the extinguishing of local jealousies between settlements on account of herd grounds. The settling of the county has narrowed the ranges for stock, until there is but little room left for it, and it has required good management and brotherly kindness to keep down feelings of contention as to the rights of neighborhoods to particular spots for grazing purposes. These general co-operative herds will amalgamate the interests of the people, and effectually prevent the growth of selfish and divided feelings upon the subject of stock. On this account we hail such movements with real pleasure. We are a united people on religious questions; let us become united in what are