(For the Scientific American.)

The Sun.—No. 1.

The sun, that vast illuminator, which imparts to us the light of day, and by his varying position in the sphere of the heavens, sways our annual seasons, bringing summer and winter alternately, is a stupendous globe, the center of our beautiful planetary world. It is separated from our globe by an immense interval; but this distance, great as it appears, is not immeasurable. If two observers, separated by a considerable distance on the earth's surface, view the sun at the same instant of time, his apparent place in the celestial sphere will not be exactly the same for both; but could his exact position for each station be ascertained, they would disagree by a few seconds of an arc. This difference in his apparent position, as seen from separate stations on the earth, is called his *parallax*. When he is observed in the horizon of one observer, and in the zenith of the other, at the same time, the difference in his apparent places is termed his *horizontal parallax*. The horizontal parallax of the sun, then, is the angle subtended by the earth's radius at his distance. Having ascertained the horizontal parallax of the solar orb, in the right-angled triangle made by the earth's radius as a base, and the two right lines drawn from the center of the sun to its extremities, we have one side—the earth's semi-diameter,—and the opposite angle, the parallax, given to determine the perpendicular, or distance of the sun from the earth's center. From the formulas of trigonometry, we find that in the right-angled triangle, the tangent of the angle opposite to the base, is to the radius as the base line is to the perpendicular. Applying this to the case under consideration, we find that as the tangent of the sun's horizontal parallax is to radius, so is the semi-diameter of the earth, to the distance of the sun from her center. It is very important that we should know the true distance separating us from the sun, within a small fraction of the whole; for upon the assumed value of this distance depends our determinations of the magnitude of the system in general. The mean equatorial horizontal parallax of this luminary has been determined very accurately from observations of the transit of the planet Venus across her disk in the year 1769. Its value deduced from these observations, is $8''{\cdot}5776$, which gives us about 24047 terrestrial semi-diameters, or, more exactly, 95,298,260 miles for the mean distance of the earth from the sun. We may safely affirm that we know our distance from the solar orb within less than a third of a million miles, or one-three-hundredth part of the whole.

Knowing the distance of a body, we have only to ascertain its apparent diameter in angular measurement, to compute its real linear diameter; for the angle subtended by any assumed measure of length, is always inversely as its distance from the vertex. The mean apparent diameter of the sun is found to be 32'. Now, as the equatorial diameter of the earth placed at the sun's mean distance would subtend an angle of $17''{\cdot}1552$, or twice the horizontal parallax of that luminary, by dividing 32 by $17{\cdot}1552$, we obtain $111{\cdot}92$, nearly, for the real diameter of the solar orb, the earth being taken equal to unity. The equatorial diameter of the earth being nearly 7926 miles, we ascertain that the enormous globe of the sun has a linear diameter of no less than 887,076 miles. The volumes of spheres are to one another as the cubes of their diameters; hence, (diameter of earth)^3 : (diameter of sun)^3 : : (volume of earth) : (volume of sun); from which, by substituting the numerical quantity, we determine the bulk of the solar orb to be that of the earth as 1,401,910 is to 1.

What an immense globe our central luminary is! Fourteen hundred globes of the size of our seemingly great terrestrial sphere, would not make up the volume of this one. He is about 28,000,000 times as large as the planet Mercury; 1000 times as large as Jupiter, which is by far the most voluminous of the planets; and has nearly 600 times the volume of all the planets, both primary and secondary, of the solar system, taken together. The whole diameter of the lunar orbit is but a little more than one half of the solar orb, so that if a globe was formed having the moon's orbit for its circumference, it would have only about one-sixth of the solidity of the sun. In fact, he is as large as the whole universe was once thought to be.

The mass of the sun is found to be above 355,000 times that of the earth; in other words, as a collection of matter, he has 355,000 times the weight of the earth; but, as we have seen, his volume exceeds her's in the much greater proportion of 1,400,000 times; hence, as the densities of bodies are to one another as their masses divided by their volumes, the sun's mean density can be no more than about $0{\cdot}25$: that of the earth being equal to unity. The matter of which the sun is composed, then, has a mean weight only one-fourth as great as that of the earth's constituent material, or is but a little more than one-third heavier than water. The forces of gravity on the surface of spheres are directly as their masses, and inversely as the squares of their radii which are the respective distances from their centers of attraction. By making the necessary calculations, we ascertain that a pound of matter on the earth, would, if removed to the surface of the sun, exert a pressure towards the center of that luminary equal to that of 28 pounds on our planet. Could a terrestrial inhabitant, weighing 150 pounds at home, be transported to the surface of the sun, he would be attracted towards the center of solar gravity with a force equal to that of 4200 pounds on the earth. He would be literally crushed beneath his own weight; but could he for a moment sustain this enormous pressure of more than two tuns' weight without inconvenience, he would be unable to move agglomerations of matter about him, several times less in mass than those he could tumble about with ease at home.

The surface of the sun, in the field of a telescope of adequate power, appears like an extensive luminous ocean. It has not the same degree of luminosity however, over the whole surface; on the other hand, large dark or black spots are frequently observed in the luminous area, as well as innumerable small ones or kind of mottlings scattered over his whole disk, and also others much brighter than the general field. The dark spots are sometimes called *maculæ*, and the small bright ones *faculæ* or *luculi*. The most interesting and conspicuous phenomena of the solar disk are its dark spots, which are frequently observable, having very large areas. The disk of the sun rarely appears to be without more or less of these spots, and sometimes many of them are perceived at the same time.

These spots which appear perfectly black in their interior, have a surrounding border or *penumbra* less dark than their central nucleus. Their penumbral border, which has generally the form of the enclosed black portion, is sometimes of a considerable breadth. Several dark spots are occasionally observed in the same penumbral area, some of which are of a considerable magnitude and others smaller. The solar spots are not permanent objects on his disk; for when watched from day to day, they are found to be almost constantly changing their dimensions; sometime expanding out so as to occupy much larger areas, and again contracting, and finally disappearing altogether. When they thus disappear, the central nucleus always shrinks up to a mere point or line, and then vanishes previous to the contracting penumbral border, which closes up, after a like manner, in its turn. Occasionally two or more spots break into one another and become a single one; and one has been observed to become divided into several. From these changes it is inferred that the luminous coating of the sun, whatever may be its nature, has a great mobility among its particles. The number and size of the solar spots are very various. The smallest space that can be seen on the solar face as a visible area, with the most powerful telescopes, has a linear diameter of 460 miles, occupying a second of angular measurement. Large spots have not only been frequently observed with telescopic instruments, but on several occasions, it is recorded, that they have been perceived by the naked eye. Spots have been seen having linear diameters of 16,000, 22,000, 45,000, and even 77,000 miles and according to the observations of some, of a greater extent than any of these. Mayer observed one 45,000 miles in extent, on the 15th of March, 1758; and more recently M. Schwabe has perceived several solar spots without telescopic aid. One of these observed in June, 1843, must have had a diameter of 77,000 miles. Could the planet Saturn be placed on the surface of the sun he would cover an area no larger than that of such a solar spot; although the volume of this planet is 800 times that of the earth. Groups of spots in common penumbra frequently occupy much larger areas. A group has been observed having a linear diameter of nearly 150,000 miles. Sir John Herschel saw a cluster of spots, at the Cape of Good Hope, in the latter part of March, 1837, which he calculated to comprise an area of 3,680,000,000 square miles.

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[For the Scientific American.]

Restoring Fruit Trees Barked by Mice.

It is not as extensively known as it ought to be, that young fruit trees can be restored to full life and vigor after the bark has been stripped off all around their stock by mice. Last winter being unusually long, and severely cold weather, and the ground covered with snow for several months, it was evident, as soon as the snow had disappeared, that these little pests had made sad destruction among the shrubbery and young fruit trees generally.

In a little orchard of thirty trees which I had planted, of the best selected fruit, and had cultivated and trained with much care for six years, until they were beginning to bear, I discovered in the spring that the bark was completely stripped off nine trees, all around the stocks close to the ground, varying in width from three to six inches. I at once banked the earth around them, so as to protect the exposed wood from the weather. In the course of six weeks after, when the uninjured trees were beginning to put out their leaves, I concluded to try an experiment and to endeavor to restore those trees that were injured; four of them I operated upon in this way: I took a straight limb, of an inch in diameter, from an older tree, and cut off pieces of such a length as to reach the sound bark above and below the injured part. I then split off slabs of about three-eights of an inch thick, with the bark—being careful not to injure the bark. These I fitted nicely into the stocks of the trees—the ends of the girdled bark fitting close, so that the connection was formed and the sap conveyed past the injured parts.

The other five trees were so badly stripped that it required strips of from six to eight inches in length to form the connections.—These I treated differently. I took young sprouts of less than half an inch thick, beveled the ends, and then raised the bark of the trees with a sharp instrument, and inserted the ends of the sprouts in the incision, and then applied plenty of grafting wax to the injured parts. When this was done, I again banked the earth around them, and applied plenty of water to moisten it well. In less than a week the buds were perceptibly swollen; they afterwards put out leaves, blossomed, and the young fruit bids fair to come to perfection. They are all flourishing equally well with the others, and no person could tell from their appearance they had been injured in any way.

To save the trouble of thus doctoring trees, it would be well to apply tar, or any other preparation that would be offensive to the mice about the roots of trees at the approach of winter.

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How and Where Gold is Found.

The most productive auriferous quartz veins in California appear in hills of what is called "the secondary formation," and run from north-west to north-east. Some of these veins have a diameter varying from four to ten feet, and the vein is generally a solid mass. The smaller veins, which run in various other directions, and connect with the main leads, furnish the most of the gold for the placers. In the large veins the gold is found in small scales or octahedrons, closely connected with the quartz; and in the small veins the gold appears in large solid masses on the surface, in the interstices, and on the outside of the quartz. These smaller veins ordinarily contain clay, accompanied by gravel, iron, and arsenic, and in these materials gold is found free from quartz. United with quartz, the gold takes irregular forms, sometimes crystalline, and the auriferous pieces are usually surrounded with clay; this quartz is almost invariably accompanied by oxyd of iron and pyrites.

The solid veins can only be quarried with difficulty, and contain the gold intimately united with the quartz. In the smaller veins the pieces of quartz hang together, but can be broken apart by a light blow. It frequently happens that in a vein not more than ten or thirty inches wide, several divisions are found, each of which is separate and solid in a perpendicular line. The perpendicular spaces between are filled with clay, which is often rich in gold.

Experience has shown that gold is generally found in quartz veins which lie near the surface of the earth; and that the gold loses in quantity and quality as the vein recedes from the surface.

In those quartz veins which have a horizontal direction, and which are found entirely isolated from other veins, large amounts of gold have been found. But these veins are very rare.

Meat and Vegetables.

In an elaborate paper by Dr. Londe, of the Imperial Academy of Medicine, Paris, recently read before its members, he lays it down as a fundamental principle in the philosophy of diet, that the use of fresh meat daily, is necessary to the health of the working classes, although he admits that persons leading a comparatively idle life may do very well on fish, poultry, and other lighter forms of nourishment. In support of his opinion he produces a number of conclusive facts; the following is one: In 1841, the Rouen Railway Co., of France, having conceded the making of their line to English engineers, the latter brought over a band of English laborers, who performed one-third more work daily than could be got out of the French laborers. The latter were put upon a meat diet, similar to that of the English workmen, and in a short time were able to accomplish the same amount of labor.

Mental Condition of the Horse.

In a very interesting essay on "Body and Mind," in the last number of the Edinburgh *Review*, it is stated that many of the mental conditions of the human being are also observable in some of the lower animals. They sleep, they dream, they become insane. They have variations in temper. The horse will weep like his master, and the big tears course as rapidly down his cheeks, from grief or pain. In the disease *rabies*, the mental character of the horse is wonderfully changed. If before the disease he was good-tempered and attached to his groom, he will recognize his former friend, and seek his caresses during the intervals between the paroxysms of fury, and he will press his head against his bosom, and with a piteous look gaze upon him, as if beseeching relief from the dreadful malady. Yet in an instant his whole conduct will change into furious madness and singular treachery He labors under an intense feeling to destroy; and there appears to be a desire for mischief for its own sake.

Real Spirit Gas.

The *New England Spiritualist* states that under the direction of spirits, a new gas machine has recently been constructed in Boston, which will manufacture illuminating gas to eclipse all others ever brought before the pub lic.

This is, indeed, good news; too good, we fear to be true, The "spirits" have long been celebrated for their abundant manufacture of gas. But, unfortunately, it has always been of a bad quality. So bad, that it has befuddled some of our most intelligent men, ob scuring rather than illuminating their intellects.

The celebrated Dumoulin remarked on hi death bed, that he would leave behind him three distinguished physicians—Water, Exercise, and Diet.