receives the dark lines of Frauenhofer exactly at the places where the spectrum of the gaseous body has shown the bright lines, while the dark intervals of the latter coincide with the colors of the spectrum.

The inferences which may be made from these facts are palpable. For it evidently follows that the sun must be a white-hot solid or liquid body, surrounded by a gaseous atmosphere, in which a number of elements, some of which are also found on our earth, are in a state of combustion. The body of the sun without this atmosphere would produce a spectrum without black lines. But since we see in the solar spectrum a number of black lines corresponding to the spectra of certain terrestrial bodies, as iron, chromium, nickle, zinc, etc., it follows that these bodies must be present on the surface of the sun, and must be in a state of combustion in his atmosphere. On the other hand, some terrestrial elements, as gold, silver, quicksilver, etc., cannot be present on the surface of the sun, since the lines, formed by their spectra, are not found in the spectrum of the sun. Many experiments have also been made, consisting in the artificial production of new lines in the solar spectrum. Thus, for instance, we find in the spectrum of *lithium* a peculiar red line. If we interpose a lithium-flame between a sunbeam and a prism, a dark line will appear on the same place; where before the red lithium line was found, and which did not exist before in the spectrum of the sun. We infer from this that lithium is *not* contained in the surface of the sun.

We may now explain the solar spots, the protuberances and the Corona. The solar spots are most probably identical with the protuberances, and both are nothing but clouds, swimming in the atmosphere of the sun similar to our clouds, which so often appear on the distant horizon as fantastic formation, like the protuberances. The Corona is nothing but this very atmosphere of the sun, of which, under ordinary circumstances, we cannot see anything, since its light is too weak to be perceived next to the intense light of the sun.

We have spoken here only of the importance of the spectrum analysis in regard to a more accurate knowledge of the *sun*. But we may remark that the spectrum analysis is just beginning to enlarge our knowledge of the other stars in an entirely unexpected manner. Thus, we know that in nearly all stars, several of the elements of the sun must be present, as, for instance, iron, sodium, magnesium, hydrogen. But there appears also a difference. Thus, in the brightest star of Orion no hydrogen exists, while in Aldebaran the presence of quicksilver is certain, which is wanting on the sun. In the spectrum of Sirius, lines have been found which cannot be produced by any known terrestrial body. We know at the same time, by the most recent discoveries, that the planetary nebulæ cannot be clusters of stars, as Sir John Herschel thought to have proved by Rosse's large reflecting telescope, but immense masses of gas without a nucleus; for their spectra do not show dark lines on a bright ground, but bright lines with dark intervals.

What a progress of science! How long ago is it that we learned to measure the heavenly bodies? Scarcely a quarter of a century have we known how to find their distances, and not much longer than we have known how to weigh them, as though we could place them in a scale. Now we discover the matter of which they are made, the metals which lie on their surface. We decompose them, as if we held them in our hands—had placed particles of them in the alembics of our laboratories.—*Kentucky Journal of Education.*

The moon's shadow will strike the earth in Siberia at 3:37 P. M. (Washington time), in latitude 58° north, and longitude 165° west of Washington, pass over the town of Okhotsh, in Siberia, at 3:43 P.M., cross Behring's Strait at 4:15 P. M., and pass through Alaska and the British Possessions striking the nothern boundary of the United States in longitude 31° west of Washington. After reaching the settled parts of the country, it will pass over or near the following cities and towns, in all of which the eclipse will be total:

In Iowa—at Cherokee, New Munich, Lake City, Boonesboro', Des Moines, Newton, Knoxville, Oskaloosa, Ottumwa, Fairfield, Mount Pleasant, Burlington.

In Illinois—at Macomb, Springfield, Decatur, Shelbyville, Mattoon, Robinson.

In Indiana—at Vincennes, Washington, Leavenworth, New Albany.

In Kentucky—at Louisville, Shepardsville, Frankfort, Danville, Mount Vernon, Mount Pleasant.

In West Virginia—at Estilville.

In Tennessee—at Blountsville, Taylorsville.

In North Carolina—at Wilkesboro', Salisbury, Greensboro', Raleigh, Fayetteville, Goldsboro', Leesburg and Wilmington, passing into the Atlantic Ocean at New River Inlet, between Beaufort and Wilmington. The cities and towns mentioned are all on railroad lines, and are easily accessible.—*Mount Auburn Index.*

The Eclipse as seen at Montreal and Quebec will exhibit an obscuration of about seven-tenths of the sun's disc.—(Ed.)

(1) A total eclipse of the sun will occur on the 7th of August next. It will be visible as a partial eclipse throughout the whole of North America.

ART.

Metallochromy.

By metallochromy, we understand the coloring of metals by means of galvanism. It is an invention of Nobili, and consists in depositing thin films of a metal on metallic bodies by means of a galvanic battery, so as to form a number of rings, and in afterward exposing the object to heat. As the deposited rings, called after the inventor Nobili's rings, are not everywhere of the same thicknes, as might be inferred from the manner of their formation, they expand unequally in heating, and thus produce elevations and depressions, though not visible to the naked eye, nevertheless cause a refraction to the rays of light, thus giving rise to the same colors that are seen in thin films of varnish, fissures in the ice on window-glass that has been partially decomposed by atmospheric action, in soap-bubbles, pearls, and which also show themselves very beautifully in heating bismuth and other fusible metals.

Nobili obtained the figures called after the name by immersing polished silver, gold, or platinum plates in a solution of acetate of copper or lead, and then connecting the two wires of a galvanic battery with them. Fechner obtained the figures by simply touching the plate with a zinc rod; thus a slight electric current was established, which reduced the metal from its solution. Elsner in pursuing the same subject, soon discovered that similar figures can be produced on steel, which takes on thereby the appearance of marbleized paper.

The longer the zinc rod remains in contact with the metallic plate, the larger becomes the rings. If the plate is then dried with linen, after having been rinsed in pure water, and held over the flame of an alcohol lamp, it will be noticed that very pleasing colors begin to make their appearance. When the color desired shows itself, the plate must, of course, be with-drawn; but the colors adhere so firmly that they bear considerable rubbing. The tints are mostly gold-yellow, steel-blue or orange-red, violet, and bronze-colored. If first a lead and then a copper solution is employed, a certain diversity may be brought into this galvanic coloration. Larger veins, sometimes similar to peacock's eyes, are obtained by using zinc rods or cylinders of a corresponding diameter; and in case the steel-plate is steeped in dilute muriatic acid, and then washed with water before being laid into the metallic bath, the colors become considerably duller. They appear most beautifully on silver and platinum; on the latter, a green color is often noticed. Dilute aqua fortis, however, destroys at once all this irridiscence, that reminds us sometimes of the hues of the wings of tropical insects.

By employing a solution of a copper salt and chloride of ammonium, Boettger produced a great variety of dark shaded colors. They too, present a handsome appearance. He found that if the zinc rod, instead of being held only for an instant over the surface, was allowed to remain in contact with the same for some time, the copper was not deposited with its peculiar red, but rather with a dark color. The previously formed red film, in disappearing, gives rise, then, to the production of the most varied hues of yellow, red, green, brown, and particularly of black. These colors remain perfectly firm by simply allowing the object to dry in the open air.

Many articles colored by the method described were first brought to the notice of the public at the German Industrial Exhibition, held in Berlin, in the year 1845. At that time, they astonished every one. Since then, the French physicist Becquered has busied himself considerably in this branch of art, and has so far succeeded in perfecting it as to obtain durable deposits of nearly every kind of metal on objects of diverse kinds and shapes. It is especially in Nuremburg and Fuerth, in Bavaria, the two most celebrated places in the world for the manufacture of toys, that this industry is carried on. In order to color iron, steel, yellow and red brass, the following process is largely employed; Seven ounces Troy weight of caustic potassa, or five and a half of caustic soda, are dissolved in half a gallon of pure water; into this four ounces of finely divided litharge is stirred, and the whole boiled for half an hour in a porcelain dish, with a frequent replacement of the evaporated water. The liquid is then allowed to settle, and is thereafter decanted from the residue. The precipate which first appears is again taken up, and the liquid assumes a deep blue tint.