nected to earth. The movable slide is formed of interchangeable plates of thin metal. If a luminous beam is now projected on the metal slide, it is found that the inner sphere becomes discharged. When a water-screen is inserted to cut off the heat, the effect is not changed. The discharge of the sphere is more rapid as the light is stronger and contains the smaller wave-lengths. An arc formed between graphite rods with aluminium cores gives a strong effect, on account of the ultra-violet rays. The discharge of the sphere ceases as soon as the passage of the light is interrupted by a screen of ebonite, etc. The effect may also be observed by reflection, and if a lead plate is placed near the box and the light reflected from its internal face, it discharges the sphere. It thus appears that a certain kind of radiation takes place within the box, coming from the inner surface of a metal plate which is lighted from the outside. This radiation will pass through a thin metal plate interposed in its path, and also through black cardboard, wood, glass and other bodies. It produces the discharge of electrified bodies, as in the case of the sphere, but does not seem to produce a fluorescence or to act upon a photographic plate, at least for short exposures. These rays differ from the cathode rays, since they traverse the metals and cardboard. They seem to have properties intermediate between the X-rays and radium rays.

THE HEAVENS IN AUGUST.

BY HENRY NORRIS RUSSELL, PH.D.

The change in the aspect of the heavens from month to month is not great, so that a description of their appearance at any time has of necessity much in common with that of the month before. We recognize this as we study the August skies. Vega, which a month ago was some way east of the zenith, is now almost exactly overhead, and Arcturus is more than half way down toward the western horizon. Hercules and Corona lie between these two stars, and Ophiuchus to the southward. Below is Scorpio, rapidly sinking to the horizon. Libra is west of it, with Virgo setting beyond. Draco is above the pole on the left, and Ursa Major below.

The Milky Way arches right across the sky. At its northeastern base Perseus is rising. Above it are Cassiopeia and Cepheus, and then Cygnus, nearly overhead. To the south we reach Aquila, and finally Sagittarius, at the other foot of the arch.

Andromeda and Pegasus are near the Galaxy in the northeast, and Capricornus and Aquarius occupy the dull southeastern sky.

Saturn is about an hour east of the meridian, and may be recognized by his brightness—he is of the first magnitude—and his yellow color. Jupiter is about an hour farther east. As he is ten times as bright as anything else in the sky, there can be no mistaking him.

Before it passes out of sight let us take the opportunity to look at one of the very few stars of whose real dimensions we have any knowledge. This object—Delta Libræ—may be found as follows: Some 15 degrees west of the head of Scorpio are a pair of fairly conspicuous stars—Alpha and Beta Libræ. Delta Libræ lies to the left of Beta, which is the upper one of the two, at about one-third the distance of Alpha and about as far from the latter as Beta itself.

It is normally of the fifth magnitude, but at intervals of 2 days 7 hours and 51 minutes it drops below the sixth magnitude, and disappears to the unaided vision. As this period is very nearly one-third of seven days, the minima occur on the same days of the week for some time. At present the best observable ones occur late on Sunday evening near midnight. As the star begins to fade about six hours before the minimum, its loss of light should be easily detected before it sets.

There are about twenty other stars that behave like this one, showing a generally constant brightness, interrupted at regular intervals. They form a well-defined class of variable stars, known as the Algol variables, from their most conspicuous member.

In explanation of their behavior it was long ago suggested that they were attended by dark companions which eclipsed them at every revolution. In the case of some of the brightest of these stars the "eclipse theory" has been strikingly confirmed by the spectroscope.

Delta Libræ is the latest addition to this class. Photographs of its spectrum, taken last spring at the Yerkes Observatory, show that the star is receding from us before minimum and approaching us after it, just as it should do on the eclipse theory. The results so far published, though insufficient to determine the orbit with accuracy, show that the orbital velocity of the bright star is about 90 kilometers, or 55 miles, per second.

Multiplying this by the number of seconds in the period, we find that the orbit of the bright star about the center of gravity of the system is some 11,000,000 miles in circumference, so that the distance of the star's center from the center of gravity is about 1,750,000 miles. How far away the dark companion is on the other side we do not know; but we have this basis for conjecture. At minimum Delta Libræ loses about two-thirds of its light. The eclipsing body, therefore, obscures two-thirds of the area of the bright star. If the eclipse is annular the area of the dark star is two-thirds that of the bright one, its diameter consequently about four-fifths as great, and its volume a little over half as much. But if the eclipse is partial the dark star may be as large as the bright one or larger.

What kind of eclipse really occurs can be determined by exact observations of the star's brightness.

In the absence of data on the subject we will assume an annular eclipse. If the stars are of equal density the mass of the dark one will be about half that of the bright one. It must then be twice as far from the center of gravity, that is, 3,500,000 miles. The centers of the two stars would then be a little over 5,000,000 miles apart.

Since the eclipse lasts 12 hours, while the period of revolution of the stars is 56 hours, they must describe about 80 degrees of their orbit during eclipse. A simple geometrical construction shows that the sum of their radii must be about six-tenths of the distance of their centers, that is, in this case, some 3,000,000 miles.

Bearing in mind the ratio of the areas of the two stars, we find for the *diameter* of the bright star the value 3,300,000 miles, nearly four times that of the sun, and for the dark one 2,700,000 miles.

This result depends on the assumption we have made. If we had assumed the two bodies to be equal in size and mass we should have found their diameters to be about 2,200,000 miles.

In any case, it is evident that this inconspicuous star is really much larger than our sun.

THE PLANETS.

Mercury is in superior conjunction with the sun on the 10th, becoming an evening star, but is too near him to be seen this month.

Venus is morning star, rising about two hours before the sun.

Mars is morning star in Gemini. On the 1st he is close to Venus, but by the end of the month he rises an hour before her.

Jupiter is in Capricornus. He is in opposition on the 5th, and, with his satellites, is a splendid object in the smallest telescope.

Saturn is in Sagittarius, well observable in the early evening.

Uranus is in Ophiuchus, and is due south at 7:30 P. M. on the 15th.

Neptune is in Gemini, observable before sunrise.

THE MOON.

New moon occurs on the afternoon of the 3d, first quarter on the night of the 10th, full moon on that of the 18th, and last quarter on the morning of the 26th. The moon is nearest us on the 1st, farthest off on the 13th, and nearest again on the 29th. She passes Mercury on the 3d, Uranus on the 13th, Saturn on the 16th, Jupiter on the 17th, Neptune on the 28th, Mars on the 30th and Venus on the 31st.

SPONGE FISHING IN THE LEVANT.

Greek and Turkish sponges have been known to the trade for hundreds of years. Syria furnishes perhaps the finest quality, and shipments are made from Tripoli and Latakia to Paris, London, Trieste, Hamburg, New York and Piræus. During the last fifteen years, however, the output has greatly diminished, owing to the introduction by Greeks, in the seventies, of diving apparatus, which proved ruinous to fishermen and fisheries alike. It is estimated that the annual exportation of Syrian sponges at present hardly exceeds $85,000 in value. In the adjoining territorial waters of Cyprus, sponge beds are being worked with varying success. Sponges were exported from that island in 1898 to the amount of $10,425, and in 1899, $28,835 worth were shipped. Egypt, Barbary, Crete, Rhodes, Samos, Calymnos, and other islands of the Turkish and Greek archipelagoes also produce sponges for export. A large share of this trade was formerly in the hands of merchants with headquarters in Symrna and Trieste, but it is now centered in London and Piræus. The United States annually buys sponges abroad to the amount of about $500,000, the principal shipments proceeding from Nassau (Bahama Islands), London, and Piræus.

The highest grades of sponges—the softest and finest in texture—are found principally in the Mediterranean. Some of the cheaper varieties are also found there, but none like those taken in Florida or Cuban waters. All through the Mediterranean, except the western half of the northern shore, three species of sponges prevail at a depth of 2 to 100 fathoms, viz., *Euspongia officinalis*, *Hippospongia equina*, and *Euspongia zimocca*.

In collecting the sponges four methods are employed—harpooning, primitive diving, dredging, and diving with special outfit.

With harpoons one of the chief difficulties is to see the bottom clearly through a troubled sea. To obviate this a wooden or zinc plate cone, like a water bucket, open at the top and with a glass bottom, is used. On looking through this water glass, which is partly submerged, the bottom of the sea may be clearly studied even at thirty fathoms and the proper sponges picked out by the harpoonist.

The primitive method of diving, with no other apparatus than a slab of stone as a sinker and a cord to communicate with the surface, is most popular in the Levant. On reaching the bottom the diver hastily snatches up as many good sponges as possible, and, after remaining under water from one to two minutes, tugs violently at the cord and is drawn to the surface. The sponges are collected in a net which the diver carries around his neck.

At greater depths, particularly along the coasts of Asia Minor, dredging is employed usually in winter, when storms have torn up the seaweeds which cover the bottom.

To these simpler operations was added some twenty-five years ago the "skafander," or diving apparatus, which enables the diver in his submarine dress to spend an hour under water at a depth of from ten to fifteen fathoms. Experience has shown that the employment of the last two methods is a severe tax upon the sponge banks, as everything in sight—sponges large and small—is gathered. Germs and seeds also suffer greatly, and it takes years before a new crop matures. The fishermen who use the skafander are frequently stricken with palsy of the lower extremities, stricture, and other complaints.

The abuses which so disastrously affect the Levantine sponge industry have prompted a Russian philanthropist, Prof. Charles Flégel, to inaugurate a campaign for the abolition of diving apparatus in sponge fishing. Through his efforts the authorities of Samos, Crete, and Cyprus have prohibited the use of the skafander; also the governments of Italy and France, the latter acting in behalf of Tunis. The question is also being agitated in Egypt. It is said the matter will be taken up and discussed at the International Fisheries Congress, which is to be held in St. Petersburg in February and March. If the Turkish government joins the crusade the skafander will most likely have to go, and, in the absence of this "engine of destruction," a new era may dawn for sponge fishers and sponge fisheries in the Levant.

As far as known no steps of importance have been taken to protect the sponge beds in Turkish waters. A close season has been proposed, but has not been established by law. The government collects from each boat using the harpoon or the primitive diving system 319 piasters gold ($14.03) a year. A skafander boat pays $145.20 per season, and its operations are limited to eight months in the year, beginning April 1. From the drag-net boat a license fee of $22 is exacted.

At present only occasional shipments of Syrian sponges go direct to the United States. Considerable quantities, however, are bought in London and Piræus. Along the Syrian littoral the demand of merchants, especially for white sponges, exceeds the supply, and prices naturally have an upward tendency. This, in connection with West Indian competition, hinders trade with America. The introduction of antiseptic surgery has also decreased the urgent demand for the Turkish article. With the advent of regular, direct steamship facilities, however, it is likely that Syrian sponges will find a fairly responsive market in the United States. Importers are referred to Dr. Harris, United States consular agent, Tripoli, Syria.—G. Bie Ravndal, Consul at Bierut.

VAPORIZATION EXPERIMENTS.

The experiment of freezing water by its own evaporation is more often described than performed, as it succeeds only with an unusually good air pump. A similar experiment with melted camphor is less impressive in one way, for the temperature required to freeze the camphor is not very low, but the experiment is far more showy, can be exhibited to a greater number at once, and is very easy to perform. A very slight diminution of pressure brings the boiling point below the freezing point, so that if a flask or test tube of melted camphor be connected to an air pump, and but one or two strokes taken, the liquid will boil under the reduced pressure, and almost immediately flash into a bulky, porous, solid mass, puffed up by the vapor that was coming off during the act of solidification.

By heating the camphor under diminished and varying pressure it is easy to change at will from sublimation to distillation. If a cold rod is thrust down a test tube in which camphor is boiling, the cooler vapor in the upper part of the tube condenses on the rod in sparkling crystals, like frost, while lower down the hotter vapor is condensing to liquid. In fact, camphor may be made to illustrate, not only the appearance, but the true cause of formation of frost, snow, etc., while, in its pleasant odor, it has an advantage over many substances used in experiments of this kind.—W. P. White, University of Wisconsin.