pinching. Owing to the fact of insects, diseases, etc., not more than half these extra buds set will produce fruit. This reduced to figures means 25 to 30 grammes of fruit per vine, an amount considered too small to pay for the trouble of pinching.

In some varieties under observation a large number of flower clusters were borne naturally on the tendrils. Thus, for example, with the variety Yapindjack from the Orient 15 bunches of grapes and 26 fertile tendrils were borne on 8 shoots naturally, against only 16 tendrils which were not fertile. It is thought that with this variety pinching the tendril, as above noted, would produce a very large increase in fruitfulness.

CAVE DRAWINGS OF THE PALÆOLITHIC EPOCH.

BY OUR PARIS CORRESPONDENT.

In a paper lately read before the Academie des Sciences, Messrs. Capitan and Breuil give a description of two caves or grottoes which they have discovered, whose walls are covered with a remarkable series of drawings of animals which date from the palæolithic epoch. The first of these grottoes, at Combarelles (France), is a long tunnel 690 feet long and varying from 4½ to 6 feet wide. Its height is sometimes 9 feet and again as low as 1½ feet. At the beginning the walls are covered with a stalagmite formation under which some rare lines are seen, but at 360 feet the clearly defined figures begin and continue to the back of the cave over a length of 300 feet, making 600 feet of wall which is more or less covered by the drawings. Most of the figures are covered with a stalagmite coating which sometimes completely hides them; many of them are 3 feet long and 2 to 3 feet high, while others are much smaller. They represent animals for the most part, and many of them are striking in their execution. All the figures are of a correct design and present details which are easily recognizable. Certain figures such as the horse are quite remarkable and show the same character as the best figures engraved on bone of the same epoch. The animals, drawn in whole or in part, include especially the horse and equidæ, the bull, aurochs, wild goat. Saiga antelope, reindeer and mammoth. All the figures are of such correct execution that there is no doubt as to their interpretation, such, for instance, as a horse of remarkable design which seems to carry on its back a kind of covering ornamented with triangles; an equide with straight mane having the upper part of the neck very convex and the tail planted very low, also a reindeer whose reproduction is strikingly faithful. The same is true for an aurochs and the head of a wild goat with long horns curved back toward the rear. As to the mammoth, a number of drawings show its well-known features, a very high forehead, curved tusks, hair completely covering the animal and indicated by a number of lines; the trunk is sometimes straight and sometimes curved backward. Some of the figures are entirely covered with the stalagmite formation. It is out of the question that the figures were executed at a period when the reindeer and mammoth were extant in France, which places them in the palæolithic epoch.

The second grotto was discovered at Font-de-Gaume, about a mile from the first. It opens midway up a chalk cliff at 60 feet above the soil of the valley. It has the form of a tunnel 380 feet long with three irregular branches of 45, 63 and 144 feet. Its width varies from 6 to 9 feet and its height sometimes exceeds 21 to 24 feet. In some places the walls come close together, forming narrow passages. The first figures of animals begin at 200 feet from the entrance, after a very narrow passage which opens at 5 feet from the ground in the middle of a stalagmite wall. The general character of the drawings is quite different from those of Combarelles and they have not the same energy and vigor of drawing. They are nearly all formed of a finely engraved line, accentuated by a band of black color from two to four-fifths of an inch wide and circumscribing the whole of the animal. Sometimes certain parts, such as the paws, are entirely painted with this black color; and some of the animals, such as a great reindeer 4½ feet long and a small equide 18 inches long, are entirely painted in black, forming veritable silhouettes like many of the Greek vase paintings. Sometimes the line is traced with red ocher, and in some cases it is very wide. But in most cases the animals, whose outline is indicated by a black line, have their whole surface covered with red ocher. Some parts, such as the head of an aurochs, seem to be painted with black and red, giving a brown color. On others the head is black and the remainder brown. These first examples of fresco painting have been applied sometimes over a series of lines engraved upon the animal and in other cases the lines have been scratched upon the painted surface. Again, the outline is sometimes brought out by an external scratched background, recalling some of the modern engraving processes. A number of the figures are covered with a stalagmite coating which is sometimes nearly an inch thick. Some of the figures are nearly on a level with the ground and others are as high up as 12 feet. Certain of them, for instance, a great aurochs entirely painted in red, measure 8 feet long, and they vary from this down to 18 inches. They represent for the most part the aurochs, of which there are 49 examples, reindeer, equidæ, deer, antelope, mammoth and a few geometric ornaments. It is probable that these figures are of a somewhat later date than those of Combarelles.

NEBULA IN NOVA PERSEI.

BY MARY PROCTOR.

The photographs of the faint nebula surrounding the new star in Perseus referred to by Prof. Henry Norris Russell in the SCIENTIFIC AMERICAN for November 30, have just been received by the writer from Prof. G. W. Ritchey of the Yerkes Observatory. They are made from his original negatives of September 20 and November 13 respectively.

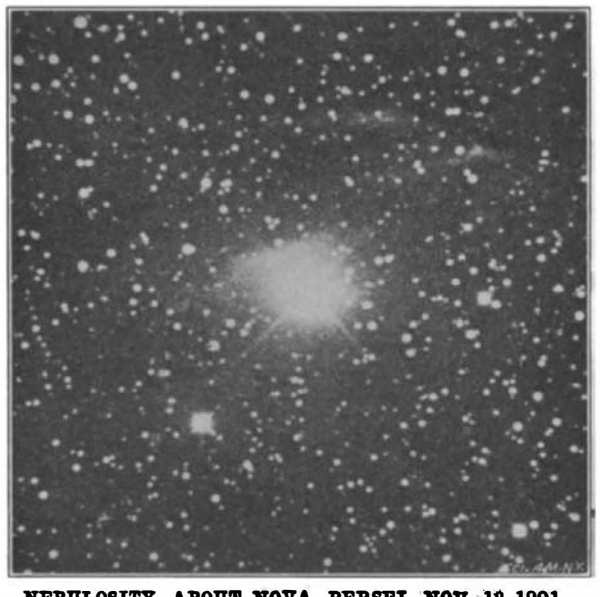
It will be remembered that attention was called in

NEBULOSITY ABOUT NOVA PERSEI, SEPT. 20, 1901.
Photographed by Prof. G. W. Ritchey, with the Two-foot Reflecting Telescope of the Yerkes Observatory. Exposure, 3 hours and 50 minutes.

Prof. Russell's article to the fact that photographs of Nova Persei revealed the presence of a very faint nebula surrounding the star. Later photographs show that enormous changes have taken place in the nebula, confirming a theory long ago advanced by Sir William Herschel, according to which changes take place in the nebulæ in the course of time.

This theory has not been generally accepted, but now it may be said to be proved by these photographs, showing actual changes which have taken place in the nebula surrounding Nova Persei during the brief period of seven weeks. This would seem to indicate that the gaseous matter forming nebulæ is ever undergoing a process of change and formation, and that from this material—the star-dust scattered throughout the depths of space—new worlds and star-systems are being evolved.

The negative for September 20 was made with an ex-



NEBULOSITY ABOUT NOVA PERSEI, NOV. 13, 1901.
Photographed by Prof. G. W. Ritchey with the Two-foot Telescope of the Yerkes Observatory. Exposure, 7 hours.

posure of 3 hours 50 minutes, and for November 13 with an exposure of 7 hours. The enlargement from the original negatives is about five diameters in each case. The negative of November 13 shows the outer parts of the nebula to have grown much fainter (though the exposure was 3 hours 10 minutes longer), while the strong wisp near the central star (Nova Persei) is much stronger.

The measurement of the negative indicates that the nebula has expanded about *one minute of arc* in all directions in seven weeks, also that it has rotated about the Nova (in the direction of the motion of the hands of a watch) through an angle of about 3 or 4 degrees in that time. The change in density of the wisp near the star is so great that it is difficult to state positively whether there has been a change of shape or position in it.

The rate of motion is of course enormous—far beyond anything known in the stellar universe before. Indeed, if we assume a parallax of 0.01 seconds for the star, the motion of the strong condensation of nebulosity approximates *that of light*. Prof. Chase of Yale has shown that the parallax is extremely small—probably too small for measurement.

The idea is suggested that the enormous changes are not due to *motion of matter* at all, but to change of illumination, electrical or other. But, according to Prof. Ritchey, the change is like that of an expanding ring. Many of the condensations, in fact all of them, are easily recognized in the two photographs, despite this change of position.

These photographs were made with the two-foot reflecting telescope of the Yerkes Observatory, which was made entirely in the optical and instrument laboratories of the Observatory. The mirror of the instrument was made by Prof. G. W. Ritchey, and the greater part of the mounting, including the clockwork, was constructed from his designs and under his supervision. He considers that this instrument is better suited for the work of photographing very faint nebulæ than any other in America, as the focal length of the instrument is very short (aperture being 23½ inches, focal length 93 inches), so that the light-concentration is very great.

SCIENCE NOTES.

A chief merit in acetylene lies in its true rendering of color shades at night, says the Acetylene Gas Journal. One of the recent large installations designed to take advantage of this characteristic is that reported from Muhlbach, in Alsace, in a cotton mill employing 500 hands. Between 800 and 900 jets of acetylene are now in operation daily. But the design is ultimately to employ 1,300 flames. Naturally enough, it is reported that all operatives are highly pleased with this and other qualities of acetylene.

The State Arid Land Grant Commission, which was created by the Legislature with power to reclaim lands given to the State by the general government, under the Carey act, has just celebrated the opening of the great canal system in District No. 4, which comprises 33,000 acres of rich land in the Dearborn Valley, Montana. The State purposes to sell this land in tracts of 160 acres to actual settlers at the cost of placing water upon the land, allowing payment to be made in ten annual installments with 6 per cent interest. Eleven thousand acres are now ready for settlement.

Consul Ravndal reports from Beirut that olive oil has many uses, but more substitutes, and few salads are compounded without the aid of one of them. Cotton-seed oil is a favorite substitute, but, according to an Egyptian newspaper, this is soon to find a sturdy rival in the form of the seed of the sunflower. Experiments made by German chemists have convinced them, it seems, of the availability of this cheap raw material, and it may shortly become a valuable article of commerce. It is said to be convertible to many uses, and, besides having possibilities as a lamp oil, may be used for dyeing purposes, and will be of service in soap making.

The directors of the Pan-American Exposition Company and a number of creditors conferred November 14 and listened to the reading of the financial report of the Company. The report shows the total liabilities of the Company at present to be $3,326,114.69 net, assuming that the assets of $146,454.15 are collectable at face. The Company owes for operating expenses and on construction work $577,945.73, which item is, of course, embodied in the figures of total liabilities. An interesting fact shown by the report is the total cost to the exposition company of the exposition. The cost, according to the report, was $8,860,757.20. The total receipts from admissions after May 1 were $2,467,066.58, and the receipts from concessions were $3,011,522.79. The balance due to first mortgage bondholders is $174,979 and to second mortgage bondholders $500,000, both of which are included in the liabilities as given.

California olive growers are preparing to harvest their crop. In every orchard in the State the trees are loaded with the fruit, and the acreage devoted to the cultivation of olives is much larger this year than ever before. In recent years the yearly crop of olives seldom ran over 2,000 barrels, or, taking seven barrels to the ton, about 286 tons. The growers who sell their olives as they come from the trees have formerly received $60 per ton for their product, or about 3 cents a pound. It costs 1 cent a pound to pick the fruit, thus allowing the growers $40 a ton for their olives. This year the total crop of the State will reach 800 tons, or 5,600 barrels, an increase of 3,600 barrels over last year. The price this year has dropped 33 1-3 per cent. Olives now bring only $40 a ton as they come from the tree, half of which goes to the pickers, thus allowing the growers only $20 a ton.