SCIENCE NEWS

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A GREAT STELLAR EXPLOSION

SEVEN million years ago a terrific outburst occurred in the distant part of the universe that astronomers know as the "nebulae of the Virgo cluster." At the Mount Wilson Observatory, in California, there has been discovered this gigantic stellar event which astronomers call a "super-nova," an extraordinary new or temporary star. It is one of the most energetic star explosions ever recorded by astronomers, and so remote that news of its happening, *via* light waves, has just arrived on earth.

So faint that the world's largest telescope, the 100-inch on Mount Wilson, was needed to record its brief rise to fame and fall to obscurity, the super-nova nevertheless at its maximum gave off thirty million times as much light as our sun. In the brilliant explosion, the star attained a velocity of expansion of 3,700 miles a second or more than 13,000,000 miles an hour.

Dr. Edwin Hubble, astrophysicist of the Mount Wilson Observatory, known for his discoveries of distant galaxies of stars, and Glenn Moore, assistant on the 100-inch telescope, discovered "super-nova Virginis, 1936," as the star will be called. For seven years they had been patiently searching among the nebulae of the Virgo cluster for such a stellar outburst. The rarity of such a happening in the heavens can be realized by the estimated frequency of one super-nova per nebula or galaxy of stars in each five hundred to a thousand years. Thus seven years was a short period of searching.

The outburst happened in the nebula listed in astronomical records as NGC 4273. The star affected is 29 seconds of arc from the nucleus or heart of this nebula. First photographed on January 21, it attained, on February 16, its maximum of astronomical magnitudes ranging 14 to 15.4. Then it faded rapidly.

The tiny pinpoint of light, while an exploding star, is so faint as viewed from the earth because it is so distant from us. By other observations, astronomers estimate that the nebula in which the super-nova is located is so remote that light takes seven million years to travel from there to the earth. Light is the speediest thing in the universe, traveling 186,000 miles per second, or six million times a million miles per year. Multiply this latter figure by seven million and you have the mileage from here to the extraordinary new discovery.

The super-nova has now faded from view even through the largest telescopes. It will probably never be sighted again. But it has won a secure place in astronomical records and study of its light spectra is expected to give more information on the way the universe operates.

Famous among the rare super-novae of the past is Tycho's star, which appeared in November, 1572, and was for some days visible in daylight and brighter than Venus at her best. Another temporary star, observed by Kepler in 1604, was as bright as Jupiter and remained visible for two years. These were much closer to the earth than the super-nova just discovered and were therefore seen with unaided eyes.

Latest of novae or temporary stars, but not in the super class with the latest Mount Wilson discovery, was Nova Herculis, which burst forth shortly before Christmas, 1934, and became easily visible in the northwestern evening sky. The super-nova in Virgo just observed probably put forth some two thousand times the energy of Nova Herculis, but the latter was more brilliant only because it was closer and in our own galaxy of stars.

What remains of novae when they fade away is a matter of speculation. One suggestion is that they become stars consisting of neutrons with no ordinary matter in their make-up. The neutron is one of the basic building blocks of matter and it was discovered in 1934. Such a spent star of neutrons would be extremely dense. The earth's mass on the same density would be a ball less than two miles diameter.

The outburst of a nova transcends in magnitude all other known physical catastrophes. Astronomers do not know just what happens. Favorite among theories is that there is a tremendous release of energy within the atoms of matter composing the star. Another suggestion is that novae occur when two stars collide.

NEW PLANETARY NEBULAE IN THE MILKY WAY

THREE large rings of star-dust, hitherto unknown planetary nebulae, have been found in the Milky Way by Mrs. Muriel M. Seyfert, research assistant at the Harvard College Observatory.

Each of them is believed to be hundreds of times larger than our entire solar system, yet they are so far distant they can be seen only through moderately powerful telescopes. Even then, the rings are not visible to the human eye but can only be detected on sensitive photograpic plates where they appear as luminous rings surrounding brilliant nucleus stars. These center stars would, of course, be visible through large telescopes.

Actually the tremendous nebulae are not rings but spheres or balls of expanding gas and tiny particles, some of them probably as fine as molecules. From their appearance on plates, however, astronomers have named them "ring nebulae." Mrs. Seyfert's discoveries were made through an examination of plates taken at Harvard's station at Bloemfontein, South Africa.

While sufficient data have not yet been assembled to permit accurate calculation of the size and distance of the rings, Harvard observers believe that like most of the approximately 130 known planetary nebulae, those found by Mrs. Seyfert are several hundred light years away from the earth and have a diameter that is expressed in billions of miles.

At present, astronomers express their size in terms of the angle formed by imaginary lines drawn from the observer's eye to the top and bottom of the stellar body. By this calculation two of the nebulae have an angular diameter of about one fiftieth of a degree. The third nebula is about one half this size.

Astronomers also believe that the rings have a density similar to that of other planetary nebulae—a density 1,000,000,000,000,000 times lighter than air. So rare is the atmosphere of the rings that, although only 12.5 cubic feet of air weigh a pound, it takes approximately 100,000 cubic miles of planetary nebular space to give the same 16 ounces.

The density is considerably less than the most perfect vacuum obtainable on earth, yet the ring nebulae are so tremendous, their total mass is measured in millions of millions of millions of millions of tons. This would be a figure followed by at least 24 zeros.

The newly discovered rings are located in the southern constellations of Norma, Carina and Ara. The nebulae of the first two are larger while their center stars have a brightness magnitude of 13.6 The Ara nebula is even more brilliant, having a magnitude of 11.9. An unusually perfect ring shape marks the Norma body.

Planetary nebulae, whose origin and place in the scheme of cosmic evolution is one of the unsolved mysteries of astronomy, are comparatively rare. From their appearance astronomers know that each is composed of a bright nucleus star enclosed in concentric spheres of expanding gas and small particles which give off light when excited by the center star, and it is thought that they may be the result of the catastrophic explosion of novae, or new stars like the famed Nova Herculis, which occurred hundreds of years ago.

FLOODS AND DUST STORMS

NATURE has again been good enough to warn us, by a perfectly synchronized drama of dust-storms in the West and disastrous floods in the East, of the wrath that is brewing against our western civilization unless we mend our ways. The two extremes, seemingly unrelated, are absolutely facets of the same picture.

The dust-storms are not simply a matter of unavoidable drought, but a result of the destruction of the living sod which alone can bind the looser soil types of the semi-arid high plains. This destruction has had a two-fold source. The range has been stubbornly overloaded with cattle almost ever since the extermination of the great buffalo herds. Wise cattlemen know the danger of this, but the pressure to liquidate their heavy debts often leads them to take a disastrous chance. The sod, cropped too close, affords too little protection against the prevalent winds of late winter and spring.

Even more serious is the second source of trouble—the attempt to farm the high plains in wheat, using power machinery. Even this year, with the somber warnings of last year's dust storm, there have been men who continued the losing gamble—one operator for example having set out not less than seven thousand acres of wheat. The wheat is as a rule unable to gain sufficient foothold during the winter months to protect the soil. Comes spring with its high winds, and the terrific dust-storms arrive.

What has this to do with the destructive floods now under way throughout the East? Recently, traveling through the oldest agricultural states of the Union the writer has scarcely seen a place where the old top layer of soil is left. Careless methods of farming have allowed it to wash away in the past two and three centuries. The insidious thing is that this has taken place without much sculpturing of the ground, so that unless one is a trained observer who knows what the soil should be like, he is unaware of the profound destruction that has been wrought.

It is this dark, spongy, top layer of soil—what the specialists call the A-horizon—which is our only effective protection against flood. One can build dams downstream, construct mazes of levees and ditches, and still not touch the source of trouble. The water must be caught where it falls, and the one thing that can arrest it and hold it in place is the dark A-horizon of the soil. This layer has been made into a perfect sponge by ages of accumulation of plant material. It will retain the water, filter it, and slowly release it in a limpid stream.

Unless we take measures, through proper use of the soil, to restore this layer—no easy task—we may expect a recurrence of disaster every time there are continued heavy rains. The problem is more a matter of biology than of engineering, and the sooner we realize it the better. Our present tactics, if we could really see them as they are, would make the wise men of Gotham blush.

Modern medicine has learned that pestilence is easier to prevent than cure. Proper land management will vaccinate our land against future floods. Nothing else will.—PAUL B. SEARS.

AMEBIC DYSENTERY IN TEMPERATE ZONES

AMEBIC dysentery used to be considered a disease of the tropics only. Since the extensive outbreak in Chicago in 1933, physicians and health authorities have found that it may and does occur in temperate zone regions as well as tropical ones. It is estimated that from 5 to 10 per cent. of all the people in the United States are infected with the disease.

The disease is spread by contaminated food and drinking water. Consequently health authorities now realize that during emergencies when water purification systems may break down, they may have not only typhoid fever and diarrheal diseases to combat but also amebic dysentery. In normal times there is always danger of the disease being spread by healthy carriers of the germ that causes it. Such persons should not cook or otherwise handle food, as they may in that way spread the disease to healthy persons.

The germ of amebic dysentery is quite large and has the scientific name, *Entameba histolytica*. It gets into the body with contaminated food or water, attaches itself to the lining of the intestinal tract and gives off daughter cysts. These are excreted from the body and, if they get into food or drinking water, start the disease in the next person.

The germs of the disease may live in the body for months without producing serious symptoms. They may reach other organs besides the intestines, particularly the liver, and cause dangerous abscesses. There are several potent remedies for amebic dysentery but they must be

used under the direction of a physician. Among the drugs used are chiniofon, carbasone, vioform and emetin.

The disease usually starts suddenly with severe abdominal pain, nausea, vomiting and chilly sensations. Sometimes it starts more gradually with mild diarrhea. There is little or no fever. The diagnosis is made by examining the excretions under the microscope to determine the presence of the ameba.

Prevention of the disease depends on proper safeguards of water and food supplies and examination of food handlers in public eating places. If the water supply becomes heavily contaminated with the germs of amebic dysentery, it is necessary to boil all the water. Chlorination, which takes care of ordinary bacteria in water supplies, would not then be practical because so much chlorine would be needed to destroy all the cysts of the amebae that it would make the water unfit to drink.

EARLY SPRING

WHEN the sun crossed the equator on its northward journey on March 20, at 1:58 P. M., Eastern Standard Time, spring officially began. Not this century has it started as early, though before 1900 it frequently began even earlier, and in 1896 actually commenced at about 10 P. M., Eastern Standard Time, on March 19.

Because the year does not contain an exact whole number of days, but nearly 365¼, the crossing of the equator occurs about a quarter of a day later each year. But every fourth year is usually a leap year, and this shifts it back again. The length of the year over 365 days, however, is about 11 minutes less than a quarter of a day, which means that each leap year it shifts back to an earlier time than it was before. This was the error of the Julian calendar, which Julius Caesar established in 45 B. C. By 1582 it had accumulated to 13 days, when the vernal equinox, the beginning of spring, came on March 11.

In that year Pope Gregory XIII set the calendar right, by omitting ten days completely from the calendar, which brought the equinox to March 22. This had been its date in 325 A. D., at the time of the Council of Nicaea, which had set the rule for determining the date of Easter. To keep it right, he ordered that century years should only be leap years if they were evenly divisible by 400.

Thus, in 1899, the equinox occurred on March 20, at about 3:00 P. M., Eastern Standard Time. Since 1900 was an ordinary year, it occurred then at about 9:00 P. M., Eastern Standard Time, and kept coming later until 1903, when its time was about 2:00 P. M., on the 21st, the latest for many years. With 1904 a leap year, it dropped back to the evening of the 20th again, and every leap year since then has been coming still earlier. In 1940 it will be even earlier than now, and it will keep getting earlier until 2099, because 2000 will be a leap year. In the year 2100 it shifts back again to the 21st, after having come as early, in the year 2096, as 4:00 P. M., on the 19th.

ITEMS

DR. S. A. WEISMAN, of the University of Minnesota, has studied the contour of normal and tuberculous chests, in which he found that contrary to previous conclusions flat chests were not an evidence of tuberculosis, but that deep-chested people were more prone to the disease. He now reports data procured from the records of 14,844 Minneapolis school children, aged from 5 to 17. This number consisted of 7,740 boys and 7,104 girls. He used the grades given by their teachers as the basis for their intelligence. A was the highest, C next and those in the F group included all below C and the subnormals. By careful tabulations of chest measurements, heights, weights and the grades given by the teachers, he found that the A and C groups had the flat chests and the F group had the deep chest. After the age of 12 in the girls and 10½ in the boys this was especially noticeable. The flat-chested children were also taller and heavier than the deep-chested.

COSMIC rays are known to be affected by the earth's magnetic field. A large part of them therefore must be particles carrying electrical charges. But are they heavy particles such as protons or light ones like electrons? Dr. W. F. G. Swann, of the Bartol Research Foundation, of the Franklin Institute, reports in favor of electrons. An experiment he has performed in collaboration with Dr. and Mrs. C. G. Montgomery, and W. E. Ramsey is described in the current issue of *The Physical Review*. High speed protons and electrons are hard to distinguish but as they near the end of their path in the atmosphere and their energy becomes nearly exhausted, it becomes easier to tell them apart. For, says Dr. Swann, "like lively old men they end their lives in a flare of increased activity." The ionizing activity of high speed particles is greatest at the end of their trajectories. With protons the end of the final burst of activity starts in some distance before the end of the path. With electrons the distance of high ionization is very short. The experiment at Bartol Foundation is designed to examine those rays which have almost reached the ends of their paths. Finding very few highly ionizing particles the investigators have decided that very few protons are present.

WHEAT'S two worst insect enemies, chinch bug and Hessian fly, had varied fortunes during the severe winter just ended. In some places the cold fought on the side of the farmer; elsewhere the pests came through relatively little scathed, according to a survey of the situation by the Bureau of Entomology and Plant Quarantine. Chinch bug's drive toward the northeast, that reached its height during the drought years, seems to have been definitely stopped. In Indiana, examinations of grasses containing overwintering insects showed mortalities from 49 per cent. to as high as 98 per cent. In the chinch bug's own native territory, however, on the southern plains and adjacent parts of the western prairies, the bug was hardly even embarrassed, despite unusually long and severe cold weather. Hessian fly is threatening from Indiana to Missouri and Kansas, and in Arkansas has in places killed as much as 50 per cent. of early-sown wheat intended for pasture. In Oklahoma the fly will probably produce a heavier infestation than last year; yet serious trouble is not expected from this insect.