SCIENCE NEWS

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ATOMS AND COSMIC RAYS

Latest news from the interior of the atom and the depths of space are blended in the annual report of Dr. W. F. G. Swann, director of the Franklin Institute's Bartol Research Foundation Laboratories. These laboratories are devoted entirely to the study of the nuclei of atoms and of cosmic radiation.

Perhaps it seems strange that atomic cores and cosmic rays should both be chosen as subjects for a single research program. Their connection, however, is quite intimate. First, the various kinds of cosmic ray particles are known to be identical with those particles shot out by the nuclei of radioactive atoms. Second, one way to learn about nuclei is to bombard them with high speed particles like cosmic rays; or, by watching what happens when cosmic rays themselves hit the atomic cores.

Some of the researches which Dr. Swann described were:

A cyclotron for nuclear investigations is being installed in collaboration with the Franklin Institute's Biochemical Foundation.

Dr. L. H. Rumbaugh has succeeded in separating the isotopes of lithium thereby producing the lightest solid ever before found at ordinary temperatures.

Dr. G. L. Locher and C. L. Haines are testing the Einstein mass-energy equivalence in the process whereby a gamma ray photon is converted into a pair of oppositely charged electrons. Verification has been established within a few per cent. The remaining discrepancy may furnish vital information about nuclear behavior.

Results of the recent stratosphere flight confirm Dr. Swann's theory that most of the observed rays are secondary particles knocked out of atoms of the atmosphere by the primary rays. Data from the balloon also show that the rays are strongly deflected by the earth's magnetic field.

Dr. T. H. Johnson will soon send up unmanned balloons for cosmic ray data in the stratosphere. The balloons and their equipment will probably be lost but will have, in the meantime, automatically radioed back the desired information. A feature of this equipment is a novel type of power plant for supplying high voltage to the cosmic ray counters. The entire equipment dangles on a string from the balloon. It will be falling slowly, however, during the entire flight, like the weight in a grandfather clock. The energy thus generated is used to drive a compact electrostatic machine.

An automatic cosmic ray recording equipment was sent on shipboard to Valparaiso, Chile, and return, by Dr. Johnson. The results reflect local variations in the strength of the earth's magnetic field.

Drs. G. L. Locher and L. H. Rumbaugh are examining photographic plates which were carried to the stratosphere on the recent flight. High speed electrical particles produce tracks in the photographic emulsion which can be seen with a microscope. Different kinds of particles can be distinguished by the kinds of tracks which they leave. According to Compton and Bethe most of the rays at high altitudes should be alpha particles, but these plates say that the number of such particles is less than one per cent. of the total. At sea-level few, if any, of the rays are protons. The plates also suggest that a certain small percentage of the cosmic ray energy at high altitudes is conveyed by neutrons.

Examination of rays which have reached the ends of their paths has shown that very few of them are protons, at sea-level. (Dr. Swann, W. E. Ramsey, Dr. C. G. and D. D. Montgomery.)

The total amount of ionization produced by a cosmic ray in passing through a gas was studied by Dr. W. F. G. Swann and W. E. Ramsey with a combination of ionization chamber and Geiger counters. Dr. W. E. Danforth is studying the primary ionization (number of atoms shattered per centimeter of path by the original ray, not counting branch tracks) by determining the efficiency of Geiger counters at different pressures.

W. E. Ramsey has shown that at least 75 per cent. of all nuclear bursts accompanying cosmic radiation are produced by photons, not by charged particles.

It has been customary to say that there were two distinct types of cosmic-ray-nuclear bursts, those in which only a few particles are ejected, and those involving a very large number, thousands even, of particles. Dr. and Mrs. Montgomery have shown that no such distinct classification is possible, that any size of burst may occur, and that they probably all arise from the same kind of process.

AN EXPLOSIVE MADE FROM CORN-PRODUCT WASTES

By Science Service Chemistry Writer

An explosive more powerful than nitroglycerine that can be made from the corn-product wastes of the nation was described by Professor Edward Bartow, president of the American Chemical Society, in an interview at the concluding sessions of the meeting of the society in Kansas City.

No mere dream is the new explosive and blasting agent which outdoes dynamite in potency. Powder companies are already investigating the new material, and if the costs can be lowered America will not only find its corn a valuable industrial commodity in the explosives field but a line of defense in time of war.

Basic material of the new explosive is a sugar-like substance, inositol, made from the waste "steeped" waters in which corn is soaked as a step in the manufacture of cornstarch. Inositol can be converted into an explosive known as hexanitroglycerine, containing six nitrogen atoms. Ordinary nitroglycerine is technically known by the chemical name as trinitroglycerine and has three nitrogen atoms.

The explosive hexanitroglycerine, Professor Bartow pointed out, has advantages over ordinary nitroglycerine because it is a solid compound instead of a liquid and can thus be used directly as a blasting agent, like dynamite. Its explosive properties are essentially the same as those of nitroglycerine. Dynamite is useful because it is a solid material and can be more easily handled than a liquid explosive. The inherent disadvantage of dynamite is that while it contains powerful nitroglycerine, the latter must be soaked up by sponge-like, non-reacting rare earths. Thus the solid dynamite is only part nitroglycerine. The rest is absorbent material.

The basic material inositol, from which such a super-explosive could be made, has been known for many years as a laboratory curiosity. It could be purchased on the open market in gram amounts for a cost of about $500 a pound. Working at the State University of Iowa, where he is chairman of the department of chemistry, Professor Bartow and his assistant, Dr. W. W. Walker, have improved the process for making inositol, so that the cost per pound is only a fraction of the former price. On a production basis demanded by the potential explosives market, the cost could be reduced to forty cents a pound, which would meet competitive figures.

Inositol is commonly but incorrectly called a plant sugar. Slight traces of it are found in the human body in the muscle and liver tissues. Its physiological significance to the body is yet unknown, but investigators at the University of Iowa Medical School are now studying the problem.

Almost all the inositol in the world just now consists of a stock of 25 pounds, which Professor Bartow keeps locked in a safe in his laboratory.

A HIGH-SPEED MOTION PICTURE CAMERA

A SPECIAL high-speed motion picture camera taking individual exposures at the rate of 300,000 a minute or 5,000 a second has been developed by the research laboratories of the General Motors Corporation to study the explosions of fuel inside automobile engines. The camera used in ordinary motion pictures takes pictures at the rate of 16 frames a second.

Dr. Gerald M. Rassweiler and Lloyd Withrow reported to the American Chemical Society that the new instrument can obtain the unblurred pictures of the spreading flame within an automobile cylinder even though an entire explosion occurs in only a brief fraction of a second. With the super high-speed camera, automotive engineers are able to analyze, picture by picture, the exact conditions within an automobile cylinder when a special quartz top is placed on it.

The technique is similar generally to the work of the National Advisory Committee for Aeronautics in Washington, D. C., which has been studying the behavior of fuel explosions in Diesel engines. When an automobile engine is running at 2,000 revolutions per minute—corresponding to about 40 miles an hour—single explosions are completed in 1/250 of a second. To study the flame properties, it is necessary to take some 20 photographs in this brief time, or one exposure every one five-thousandths of a second. To avoid blurring of each picture at this high rate of speed, the new General Motors' camera operates in a fashion somewhat similar to a scanning disk of a television set.

"If only a single stationary lens were used to photograph the explosion flame," said Dr. Rassweiler, "the picture would be streaky and blurred. This spreading action is avoided by mounting 30 small lenses in a steel disk and arranging them so that, as each moving lens passes the stationary lens, an image of what is happening inside the combustion chamber is formed. This image moves with the film as the picture is being exposed. Blurring is thus avoided even though the picture is exposed long enough to produce a good image on a film which is moving at rates as high as 250 miles an hour."

THE CLASSIFICATION OF COAL

A NEW chemical yardstick for determining the qualities of coal was reported to the American Chemical Society at Kansas City. It allows scientists to go back through the millions of years in coal's prehistoric history and put their fingers, in a figurative sense, on long past happenings that make one kind of coal differ from another. Different kinds of coal, according to a report made by Professor H. L. Olin, of the State University of Iowa, have a strong attraction for oxygen and it is this affinity which is used as the basis for the new chemical test. Coal, Professor Olin recalled, is the fossil remains of ancient vegetation and the various kinds of coal represent different ages of this fossilizing process. Peat is a relatively young coal which has changed but little from the reeds and grasses of the bogs in which it was formed. Lignite has gone a step further in coal's life history. It has the appearance of coal but retains the woody structure of the long departed parent plants. Going up the geological family tree of coal, the various bituminous grades and finally anthracite are reached. All the while the buried coal mass is changing chemically with a loss of hydrogen and oxygen and a concentration of carbon.

Using the chemical, potassium permanganate, as the oxidizing agent, Professor Olin has made a study of various coals from the lignites of North Dakota to the semi-smokeless coals of West Virginia. The oxygen test places these coals in their order of rank as determined by other less simple methods. The new development, he believes, should prove useful in the work of establishing an official method of coal classification.

HOW WE SEE

WHY the movies appear to us to be pictures in motion rather than the rapid succession of still pictures they really are is explained by recent work from the Columbia University biophysics laboratories.

Dr. Selig Hecht, chief of the department, is well known for his studies of how we see, particularly for his researches into how the bleaching by light of a dye called visual purple, the sensitive material of the eye, results in vision. In a talk delivered to the biologists at Rutgers University he recounted a series of researches into why a light turned on and off fast enough appears to be uninterrupted. Light bleaches the dye which the eye regenerates. In darkness a larger amount of the dye is built up than in light, making the eye more sensitive. It is this which makes us more sensitive to light after being in the dark. When a light flickers fast enough, as is the case when [illegible]tion pictures, not enough visual purple is built up for the eye to become specially sensitive to the following flash of light; hence, no flicker is perceived. But when the light flickers more slowly, as for instance at the fifty-times-a-second of the electric light bulbs in the New York subways, enough visual purple is rebuilt in the dark periods to permit the eye to realize that there is a flicker.

Illustrating the pitfalls that await the unwary investigator are the kind of lights that had to be used. Other investigators had used broad beams of light to illuminate the eye for these experiments, and had obtained results which were difficult to interpret. The eye is not homogeneous, there being two kinds of apparatus in it for receiving the light impulses, but in small areas, one at the center of the retina, the other around its edge, these two kinds exist separately, not together as in the rest of the retina. These tiny areas were used for the experiments, illuminated with very narrow beams of light.

WHY IS A WEED A WEED?

WHY is a weed a weed? The answer may be any or all of a number of reasons, according to a survey of a hundred common weeds in the Chicago region made by Oliver Duggins, of the department of botany of Northwestern University. The main factor is the plant's aggressiveness in taking root in gardens, or other spots where it is not wanted, and in crowding out desirable plants. Mr. Duggins has outlined approximately a dozen factors that operate to produce this aggressiveness.

Although he says there are many other factors involved, Mr. Duggins has particularly studied the influence of the origin of the plant, the type of root system, whether the plant is annual, biennial or perennial; reproduction, the length of the flowering period, the number of seeds produced, the means of seed dispersal, the percentage of germination in the seeds, physical soil types frequented by the plants, whether the soil is alkaline or acid, the moisture requirements of the plant, the shade and sun requirements of the plant, the relation of weeds to man, and the arrangement of the plant's leaves and aerial parts. The fact that about 75 per cent. of the plants classed as weeds are natives of other countries, being brought over in ships' ballasts and in packages of ornamentals and medicinal herbs, is evidently an important consideration.

The dandelion can literally be called the king of the weeds, being one of the weediest of weeds, because of its large number of aggressive characteristics. Heavy tap roots which store up food will pull it through heavy winters. It is not particular about its soil, which can be rich or poor, rocky or black dirt, acid or alkaline, wet or dry. Allowing gardeners no rest, it blooms nine months out of the year in the Chicago district.

Plumes acting as sails afford an efficient means of spreading about 15,000 seeds produced by a single plant; eventually 64 per cent. or more of these seeds germinate. Even if the gardener found time to pluck all the yellow seed-producing flowers from the dandelion, the plant would grow again from its roots. Its low under-slung stem and leaves, below the reach of the lawnmower, shade and prevent competing plants near it from growing; thus it has more food fo-

ITEMS

A FAREWELL photograph of Anteros, the newly discovered baby planet, was taken April 11 with the giant 100-inch reflector at the Mount Wilson Observatory, according to an announcement issued by the Harvard College Observatory. This last observation, taken when the magnitude of the object was only 20.5, is considered of exceptional value by astronomers because it gives them great "leverage" in calculating the planet's orbit exactly and thus is an important clue as to when the body may return to the neighborhood of the earth. Anteros, only one third of a mile across, is at present about one hundred million miles from earth, having crossed the orbit of Mars. On February 7 it was little more than one million miles distant, the nearest of any asteroid or other celestial body except the moon. At that time it was receding at the rapid rate of a million miles a day but it has now slowed down to approximately half that speed. Within a year, astronomers estimate, its speed of recession will have diminished to zero and it will then turn around and come back toward the sun—and earth—with steadily increasing speed.

ALTHOUGH it has faded, Nova Herculis, the star in the constellation of Hercules that was seen to flash out from previous obscurity at the end of 1934, is still engaging the attention of astronomers. Several months after discovery, it was observed to break into two parts, and each part seems to have produced its own spectrum, in the series of dark lines seen when its light was analyzed through the spectroscope. This is the suggestion of Dr. W. W. Morgan, of the Yerkes Observatory, writing in the forthcoming issue of *The Astrophysical Journal.* In January, 1935, two sets of these lines were observed, but at the time they were difficult to explain. When the star broke into two, one component seems to have been traveling in our direction at a speed of 530 miles per second, while the other was receding at 675 miles per second. This is the reason that the lines were seen in duplicate. The lines from a body traveling earthwards are shifted to the blue end of the spectrum, while those from a star speeding away are moved to the red. Had both pieces been traveling at right angles to the direction of the earth, their spectra would have merged.

KILAUEA, the volcano in the Hawaii National Park that periodically holds the famous lake of fire, probably will experience a period of quiet, in the opinion of Dr. T. A. Jaggar, volcanologist of the U. S. National Park Service. Dr. Jaggar, who has studied and predicted eruption of the two well-known volcanoes of Kilauea and Mauna Loa over a long period of time, believes that the spectacular activity of Mauna Loa in the closing months of 1935 so gave vent to the underground steam pressure that the return of activity to its neighbor Kilauea will be retarded. Observations at Kilauea confirm this belief, as its great pit of Halemaumau—a Hawaiian word sometimes translated "House of Everlasting Fire"—has been unusually quiet during recent months, the only activity being some sliding of material from the northeast rim.