SCIENCE NEWS

ALL STARS PROBABLY HAVE SAME COMPOSITION

Science Service

CONTRARY to what has formerly been supposed, hot stars and cool stars probably are very nearly the same in chemical composition, Dr. Henry Norris Russell, director of the Princeton University Observatory and research associate of the Mount Wilson Observatory, declared in an address before the Carnegie Institution of Washington here tonight.

"Recent physical research has told us so much about the properties of atoms that we have come to a new understanding of what we observe in the stars," said Dr. Russell. "Our knowledge of the composition of the stars depends upon the lines which we observe in their spectrum and which show the presence of many of the familiar chemical elements.

"The atmosphere of the cooler stars are full of the vapors of metals, while in the hottest stars the metals seem almost to disappear and to be replaced by gases such as nitrogen and helium. It has been supposed that this means that the stars differ in chemical composition, or that atoms of one kind are changed into those of another kind at such high temperatures; but in the laboratory we can subject atoms to far more violent treatment than they receive in the atmosphere of the stars without the least sign of their changing into atoms of other sorts. We can, however, knock one or two electrons off the atoms, and each time an electron is removed the spectrum of the light given by the atom changes entirely. After two or three such changes there are practically no lines left in the accessible part of the spectrum, though there may be strong radiations of ultra violet light or X-rays."

Dr. Russell said that in the hotter stars the atoms of the metals are in this condition and though still present, do not reveal themselves to the spectroscope. On the other hand, he said, gases like helium are so hard to set shining that it is only in the hotter stars that we can tell that they are there. The most abundant elements, such as hydrogen, show their presence when less abundant ones would disappear.

"This theory of ionization makes it probable that all the stars are very similar in actual composition—the observed differences arising from differences in the state in which the atoms find themselves in their atmospheres," he concluded. "On these principles it is already possible to reach conclusions about the temperature and pressures in the atmospheres of the stars. The pressures seem almost always to be very low and the gas so rarified that we would almost call it a vacuum in the laboratory. The temperature in the hottest stars probably reaches 25,000 degrees."

Deep in the interior of the stars the temperatures are enormously higher and are probably millions of degrees, Dr. Russell estimated. Here it is possible that once in a while atoms of one element do become changed into atoms of another kind. There is reason to believe, he said, that if hydrogen atoms are changed into others an enormous amount of heat would be set free, which would suffice to keep the stars shining for billions of years.

TRACES OF CHEMICALS DO GOOD AND HARM

Science Service

NEGLIGIBLE traces or impurities may mar or make a chemical process or a product, Jerome Alexander, consulting engineer of New York, told the American Institute of Chemical Engineers at its annual meeting.

The Germans scrapped their own poison gas plant when they learned how the British made their "mustard gas" or diethyldichlorsulfide during the war by analyzing it and determining its impurities, he explained in labeling such traces telltales.

"Among the traces that help are vitamines," he said. "Also the value of traces of salts in water, for brewing, baking and other operations, is beginning to be appreciated, and we hear now of these being specially added. While 0.216 per cent. of arsenic reduces the conductivity of copper 39 per cent., pure copper rolls much less readily than that containing arsenic, and yields tubes that corrode ten times more rapidly. A little lead in brass makes it machine easily and prevents chattering. The reputation of Swedish iron is due to the manganese impurities it contains. A little copper inhibits the corrosion of steel. Small quantities of barium harden lead and make it ring like a bell. In many alloys

small quantities of aluminum deoxidize the melt and prevent atmospheric corrosion of the casting. In the electrodeposition of metals small quantities of 'addition compounds' which are in many cases protective colloids, give a desirable cathodic deposit. Auer von Welsbach found the great effect produced by ceria in the thoria mantle, the optimum value being about 1 per cent. Thus in a certain flame a pure thoria mantle gives 7 candle power, whereas the standard mantle with 1 per cent. ceria gives 88 candle power. With ¼ per cent. ceria the luminosity sinks to 56 candle power, while with 5 per cent. ceria it is only 44 candle power. Goodyear had no trouble in vulcanizing his rubber because of the various nitrogenous impurities present in the crude product of his day. With the advent of modern pure plantation rubber, it has become necessary to add various accelerators. Old patents show that celluloid dissolved in the "wood spirits" of that day, which contained ketones in considerable quantity, but refined wood alcohol is not a solvent for it. Traces of lead tetra-ethyl will take the 'gasoline knock' out of an internal combustion engine, even 0.06 per cent. being effective."

But other traces hinder rather than help, Mr. Alexander said. Iron was described as powerful in small amounts. A manufacturer of brewing sugar came to see how his new product was working in a brewery and found the brew-master running an inky black liquid into the sewer, he related. Being a chemist, he immediately wired his analytical department that their product was full of iron, and in reply received a telegram saying that the batch complained of had only 0.002 per cent. of iron. But that was enough to make plenty of ink with the hop tannins.

"In making dry batteries, traces of iron in the pyrolusite or of copper in the ammonium chloride are highly objectionable," he said, giving further examples. "One part of sulfur per million in cocoanut oil is said to create trouble in the soap making process. In lead burning traces of arsenic in the hydrogen used to make it impossible to secure a good joint. Attempts to make a good nickel steel were for years frustrated by impurities present in the commercial nickel of the day."

PLAGUE RATS MENACE HAWAII; BUT POISON CAKES COMBAT THEM

Science Service

LIVES and fortunes are the stake in a tremendous war against field rats now being conducted by the territorial board of health and the sugar plantations of the Hawaiian Islands. The results of this war are likely to be of assistance throughout the world in campaigns against the rat, one of the worst enemies of mankind.

It is stated by those who have studied the problem at the experiment station of the Hawaiian Sugar Planters' Association that the common field rat destroys sugar cane on these islands valued at $100,000 each year, and probably the damage is in excess of this sum.

Worse than this huge tax on the industry, however, is the ever present danger of bubonic plague from infected rats. Twelve deaths among Japanese and Filipino plantation laborers occurred within the past few months on the Hamakua coast, island of Hawaii.

A new and successful method for wholesale killing of rats has just been discovered. Poison rat-cakes are being manufactured by the millions at Honokaa plantation and are spread broadcast through more than ten thousand acres of cane fields and waste areas, resulting in the death of so many rats that where the board of health previously trapped over two thousand rats a month, it now catches only about fifty.

The poison used is barium carbonate, deadly to rats and field mice, but only slightly poisonous to human beings, livestock and poultry. The poison is mixed with flour dough and made into small round cakes less than an inch in diameter and about one fourth inch thick.

A new and very important feature, for which patents have been applied, is the coating of paraffine over the cakes to protect them from dampness and moulding, thus insuring their effectiveness for many months. A very small nibble at one of these poison cakes will kill a mouse, while a piece as large as a small pea will kill a rat. Honokaa Sugar Company is manufacturing these rat-cakes chiefly for its own use, but it is also selling some at nominal cost for trial use on other plantations.

A man on horseback, dropping a rat-cake about every ten feet, can cover an area of 35 acres in one day, at a total cost of sixteen cents per acre. This done two or three times a year is sufficient to control thoroughly this very serious pest.

Other poisons have been tried at Honokaa. The best of these is strychnine wheat placed in small bamboo tubes and wrapped with paraffine paper. The usual methods of poisoning are intended for use on a small scale and no effective system has been evolved previously which is cheap enough to use over large areas and impervious to the weather.

Many efforts were made along other lines before

poisoning was decided upon as the one effective plan. The U. S. army stationed in the islands had offered assistance in the way of poison gas experiments, as it realized the seriousness of the plague situation.

C. E. Pemberton, assistant entomologist at the sugar planters' experiment station, was assigned to investigate this possible means of control, but he reported:

"The use of gas in any form for combatting rats in the cane fields is wholly impracticable. Rat burrows, deep, extensive and permanent, are common, but extremely difficult to find until the cane has been cut and the trash burned. By then the rats have left the burrows. A minute search in any field, before harvesting, would reveal most of the rat burrows present, but the time required for such work would be far too great to warrant such a procedure."

Trapping was also experimented with and found unsuitable for use over so large an area.

The board of health is leaving the experimental work to the sugar planters, and is using its energies in cleaning up rat infested places in the labor camps. The people of Hamakua are giving the board every assistance in ridding the district of the menace. Camps are being cleaned up, rubbish is being burned and intensive trapping is conducted around houses and barns. All stray dogs and cats have been killed as it has been found that they also are capable of carrying the plague.

MESOTHORIUM

U. S. Bureau of Mines

THE chemistry of mesothorium, the radio-active element found in monazite sand and other thorium minerals, which is used as a substitute for radium in the manufacture of certain luminous paints and for medicinal purposes, is discussed in Technical Paper 265,byHerman Schlundt, just issued by the United States Bureau of Mines.

Among the thirty-odd radio-active elements, mesothorium, the first product of thorium, ranks next to radium in importance, states the author. Like radium, its disintegration products emit the three types of radiation that are characteristic of radio-active substances and that are known as alpha, beta and gamma rays. Mesothorium decays at least 250 times faster than radium, and hence in the pure state its activity, weight for weight, would greatly exceed that of radium. Although itself rayless, its first product, which is rapidly formed after mesothorium has been separated, gives a powerful beta and gamma radiation; the alpha radiation of freshly prepared radium attains a maximum within a month, whereas that of mesothorium increases comparatively slowly, and reaches its highest point during the fifth year after separation. Mesothorium preparations therefore must be "aged" before their full alpha-ray effect is realized in luminous products.

During the first years of separation, notwithstanding the comparatively rapid decay of mesothorium, its preparations maintain a higher gamma-ray activity than an equivalent quantity of radium. Mesothorium may thus serve as a substitute for radium, both in luminous compounds of radium and for therapeutic purposes.

Uranium ores, especially carnotite, are worked primarily for the extraction of radium—uranium, vanadium, etc., being secondary products. Mesothorium, on the other hand, is obtained as a secondary product or a by-product in the manufacture of thorium for the gas-mantle industry, its output being governed by the demand for thorium nitrate.

For a good many years the production of mesothorium in Germany, and to some extent in other countries in Europe, has kept pace with the production of radium. The Germans early recognized the value of mesothorium as a substitute for radium, not only for luminous paint but also for medical purposes. Only during the last two or three years, however, has production taken place in this country. Two companies have been recovering mesothorium as a by-product in the extraction of thorium. The Bureau of Mines has had a cooperative agreement with one of these companies. Very little has been published concerning the recovery of mesothorium. Methods of measurement have been uncertain and somewhat difficult, and Dr. Schlund's paper is intended as a contribution to the chemistry of this useful and interesting element.

Experiments of the Bureau of Mines in determining the ratio of mesothorium to thorium by direct comparison of gamma activity with radium are described in this paper.

WOULD REQUIRE PEDESTRIANS TO SIGNAL AUTO TRAFFIC

Science Service

SIGNALS by pedestrians to show automobile drivers their street crossing intentions were proposed here to-day by Dr. Raymond Dodge, chairman of the psychology section of the National Research Council, as a means of making city traffic more safe.

"It is often quite impossible for a driver to determine when a pedestrian is going to start across the street, when he is going to retreat, or what direction he is going to take," Dr. Dodge said, and suggested that it would be a great help to drivers if pedestrians were required to indicate their intentions in some such way as the chauffeur is required to do in making turns.

"A simple scheme for the most desirable starting time and duration of signals can be worked out by any psychologist who knows the limitations of attention and reaction-time and will familiarize himself with the traffic situation.

"It is possible that there also ought to be tests for pedestrians as well as drivers, with distinguishing marks for incompetents. It would be some help if the driver could know that the man trying to cross the street was partially paralyzed, partially blind or deaf, had a wooden leg, or some other disability which made it difficult to take care of what he had left. As it is now, youth and old age are the only clearly marked incompetents.

Much has already been done to diminish the sources of confusion, such as the introduction of traffic signals and the establishment of zones or islands of safety where pedestrians can take their problems in smaller doses. But, if I am correctly informed, a systematic analysis of confusion of pedestrians or drivers has yet to be made. Such a study would involve the practical limits of attention and the facts of human variability. The sudden appearance of an unheralded vehicle coming around the corner, the convergence of vehicles on a pedestrian and even the blatant automobile horns themselves are worth considering as sources of confusion.

"Advantages would be derived from one-way traffic. Confusion would be diminished by uniformity of traffic rules, and signals, by better lighting of cars, and a better system of street lighting. Most street lighting involves decrease of the visual acuity by glare. Pedestrians should also have training in time and space estimation.

In addition to the possible services of psychology in the regulation of the highway, there is undoubtedly need for the services of expert educationalists," Dr. Dodge said. "The pedestrian must be trained as well as the driver of motor vehicles and the proper place for that training is in the school. It seems reasonable to suppose that one of the most important school functions in fitting the child for his environment is the ability to take care of himself on the highway. This task can be undertaken only when the regulations of the highways have reached a point where it is uniform in all the states and uniformity should only be aimed at when we are sure that from the standpoint of space and time as well as from the standpoint of the human mind the proposed regulations have been thoroughly scrutinized and revised."

"Newspaper and movie campaigns by cartoons, advice and stories," Dr. Dodge added, "should be continuous and not limited to one week in the year."

SCIENCE ITEMS

Science Service

SCIENTISTS, government officials, fruit growers and nurserymen met in Washington on November 20 to discuss means of checking the latest Japanese invasion to gain a foothold in this country. The camphor scale, a newly discovered crop insect pest, is spreading rapidly among camphor, satsuma orange, olive, privet, Japanese persimmon, fig, plum and pecan trees in Louisiana and Alabama. Drastic measures to prevent the spread into other states were suggested as the experts gathered. The insect has been traced to an importation of satsuma orange trees direct from Japan just before the plant quarantine barriers were put up in 1911-12. This scale has been classed as a menace with the Japanese beetle, the European corn-borer and the pink boll worm, which gained a footing about the same time. A federal quarantine on the two states invaded to protect the other citrus-growing regions of the country from attack by prohibiting the movement of nursery stock and other articles likely to carry the pest is being considered.

ONE DOLLAR from each of the Knights of Pythias, $1,000,000 in all, has been donated by the Supreme Lodge of that order for benefit work among the lepers of Culion Island and to carry on the search for an absolute cure for that dread disease. Part of this fund will be used in the erection of a fully equipped experimental laboratory.

PASTEUR, great French bacteriologist, whose centennial is to be celebrated in December, spent five years studying the diseases of the silkworm for the Department of Agriculture of France.

MORE than seventy per cent. of the world's production of crude rubber is consumed by American rubber manufacturers.

ALGERIAN sheep are comparatively immune to anthrax, while all other sheep seem extremely susceptible to it.