SCIENCE NEWS

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NOVAE

A TEMPORARY star or nova which suddenly flares up in the heavens without warning and then gradually fades, is not quite the cataclysmal event that some theoretical physicists have supposed. This view was expressed by Dr. Dean B. McLaughlin, professor of astronomy at the University of Michigan and secretary of the American Astronomical Society, speaking before a recent meeting of the Rittenhouse Astronomical Society at the Franklin Institute.

The outburst is a surface explosion, Dr. McLaughlin believes, of tremendous proportions to be sure, involving as it does the entire surface, but not necessarily fatal. After "blowing off steam," the star returns to approximately its former state. Its temporary excursion into notoriety produces little change in its normally humdrum life.

Dr. McLaughlin's view is based on a personal examination of all spectra of "novae," or new stars gathered at the University of Michigan Observatory and at the other leading observatories of the United States. It is a good idea, he said, for "one set of eyes, with one set of prejudices" to examine all the observational material.

New stars at maximum light, he explained, are about 50,000 times as bright as the sun, though they are so far distant that they appear like ordinary stars. Before outburst they are about the same real brightness as the sun but are smaller, denser and hotter—a type known as subdwarfs. Increase of light from minimum to maximum takes only a few days, but the decline takes several years. The flare-up must be due to an explosion whose cause is not known. The surface layers expand as a cloud of gas around the star at a speed of hundreds of miles per second. After some months the expelled clouds of gas become visible as a faint nebula around the star. At the end of the decline the star is apparently not changed from its previous condition, and it must be concluded that all the disturbance is superficial.

Altogether about 90 novae have been recorded in our milky way system, and over 100 have been found in the neighboring spiral nebula Andromeda.

ENERGY OF THE SUN

MAN is harnessing the sun to supply power for his home, factories and vehicles. Long a dream, present research indicates that the future world may be powered by energy snatched from a sunbeam. But practical application awaits results of the long-range research program now being conducted.

Many such glimpses of happenings in science are presented in the annual report of the Smithsonian Institution, which has just been issued.

Utilization of scientific advances in post-war reconstruction, however, will require sources of power not dependent on dwindling resources. Energy equal to 21,000,000,000 tons of coal which the sun showers on the surface of our globe every hour, offers fascinating possibilities.

There is one major obstacle to harnessing this power: economics. Power produced, the report indicates, depends directly on the area over which solar energy is gathered. This would need to be large and the cost consequently high. Solution of this problem has been a foremost objective of Smithsonian Institution researches.

Dr. Charles G. Abbot, secretary of the institution, has built highly efficient solar engines which have come close to economic practicability compared with other power-producing systems.

Various possibilities of solar energy are outlined by Dr. H. C. Hottel, of the Massachusetts Institute of Technology, where experiments are also being conducted. Their program calls for exploration of all the possibilities of economic conversion of solar energy into forms useful in industry.

One method would be direct conversion of the sun's rays into electricity. This would be based on the principle of the thermocouple. That is, when two wires of two different elements are joined and the junction is heated, a small part of the heat is converted into electrical energy. Efficiency here depends on the properties of the two materials used. Intensive study is now in progress to learn which metallic compound give the best results.

Another apparatus is operated by photoelectricity—the same principle which operates the exposure meter used by photographers. Here the light strikes a specially prepared metal plate which also results in conversion to electrical energy.

Or perhaps, it is suggested, we can duplicate nature's own method of storing solar energy. Through chlorophyll, the green stuff in leaves, sunlight is stored in growing things. Perhaps millions of years later it is released by the burning of coal or oil. It is hoped that through a thorough understanding of nature's process, we may be able to make synthetic fuels out of easily available chemicals in a few minutes.

Atomic power, discussed by Dr. Ernest O. Lawrence, of the University of California, is also much in the news. Recent progress must be kept secret at this time. But up to about a year ago the status was about that of aviation fifty years ago. That is, the basic principles are known, but practical application awaits the development of a new instrument or technique.

THE CORROSION OF IRON PIPES

BACTERIA have been found responsible for corrosion of iron pipes carrying deep well waters in the Miami Valley, Ohio. These waters contained very little oxygen and practically no other corrosive substances that could be detected by the usual chemical test. Similar trouble with "red water" at Middletown, Ohio, has been cleared up with chlorine treatment which killed the bacteria.

The investigation which lead to this discovery was carried out by Dr. Arba H. Thomas, chief research chemist of the American Rolling Mill Co., of Middletown.

The organism chiefly responsible, Dr. Thomas found, was cocco bacillus, an organism of the anaerobic type. This type requires no oxygen for its life processes. In fact oxygen is poison to it. This type reduces sulphates in the water and liberates hydrogen sulphide which attacks the iron producing the black iron sulphide. This kind of corrosion is therefore very different from that produced by electro-chemical action which results in the red oxide of iron or rust.

Other organisms, the so-called "iron-consuming" bacteria, were also found. These, the crenothrix, spirophyllum and leptothrix, do not actually devour metallic iron, but they do consume dissolved ferrous salts, converting them to the insoluble red ferric hydroxide or a similar substance, producing "red water."

By introducing oxygen into the water, it was found that the rate of corrosion decreased as the quantity of oxygen increased, just the opposite to what would have occurred if oxygen had been the cause. These bacteria, Dr. Thomas said, have long been known to biologists, but their connection with corrosion was only recently suspected. They are not disease producing.

The remedy is to chlorinate the water, or where it is to be used for drinking purposes and the chlorine taste would be objectionable, the chlorine-ammonia or chloramine treatment can be used. This not only kills the bacteria, but removes any deposits that have already been formed on the metal. Ordinary lime-soda softening treatment will kill the less resistant types of bacteria, but not the hardier ones. Also a good coating of a coal-tar base enamel will protect the metal.

OIL FOR THE ALASKA HIGHWAY

AVIATION gasoline and diesel engine oil will soon be flowing through a new pipeline toward the Alaska highway from oil wells and the world's most northern refinery at Fort Norman on the Mackenzie River in Canada 125 miles south of the Arctic Circle. Vast untapped tar sands in northern Alberta are being moned for oil, gasoline, asphalt and coke.

The wells at Fort Norman have been in existence since 1921. They were little used, however, in fact were capped until 1930, when discovery of radium on Great Bear Lake shores brought aerial prospectors in vast numbers. Shortly after the outbreak of war a new refinery was built at Fort Norman producing aviation gasoline and diesel engine oil. This plant, according to Munitions and Supply Minister C. D. Howe, has now been expanded, and will probably be in use for a longer period than just during the summer, as it has since installation.

"An intensive study of the tar sands is under way at present time," stated Minister Howe, in Parliament. "To-day we think of that area as a source of immediate oil production, provided the problems connested with its development can be solved rapidly and with some degree of certainty. Arrangements have been made to develop further the wells on the lower Mackenzie River at Fort Norman. Additional wells are being drilled, the refinery capacity is being increased, and a short pipeline is being installed to bring the oil across to the location of the Alaska highway."

From the sands along the Athabasca River in northern Alberta, Indians have since time immemorial used pitch to caulk their canoes. The first white men to come into the area in 1788 found the oil sands to stretch for miles, and in some places found oil bubbling to the surface. Since the settlement of Alberta many attempts have been made to obtain oil from these oil-rich sands. Last year the first successful commercial extraction plant began operations to obtain lubricating oil and gasoline from the tar sands.

The oil sands along the Athabasca River are considered by oil authorities to be one of the largest oil reservoirs in the world. According to the geological estimates of the Canadian Government, the oil sands contain at least a hundred billion barrels of oil. But it will be a big job to get it out.

Because of transportation difficulties and because no suitable extraction system had been devised, the oil sands remained unworked. These oil-saturated sands range in thickness from a few feet to 225 feet, and in oil content up to 25 per cent. by weight. They cover an area estimated at from 10,000 to 50,000 square miles. A large part of the area is overlain with shale and sandstone up to a maximum depth of 1,800 feet, and underground methods of mining are not considered workable. The oil will not flow into wells fast enough to be pumped commercially. But erosion on the Athabasca River and its tributaries has left benches that can be mined by open pit methods.

The bituminous sands have produced a high quality of asphalt which has been used for paving fairly extensively in the past, and it is expected to be used for this purpose also on the Canada-Alaska Highway now being built. They stretch for miles on each side of the river, covering roughly an area 115 miles north and south, and 55 miles east and west. The sands lie about 600 miles north of the international boundary in an area which can be developed the year round.

The extracting plant which went into operation last year on a small scale took 11 years of research by American engineers to develop. The sands go through a separation process, then to a refinery where the crude oil is turned into gasoline, diesel fuels, fuel oils, asphalt and coke. It is thought that synthetic rubber may also be developed from these bituminous sands after they pass through the separation process.—JAMES MONTAGNES.

ITEMS

A CONSIDERABLE sector of the vast plastics industry is founded on coal, Dr. R. L. Wakeman, of the Mellon Institute, and Dr. B. H. Weil, of the Gulf Research and Development Company pointed out. Some of the best known and most useful plastics are formed in part of phenol, and phenol is a coal product. The other half is often formaldehyde, made from water gas, which in turn comes from coal or coke. These plastics play their part

in war as gunstocks, mortar projectile noses, bulletproof transparent noses and turrets of planes, instrument panels and handles of a hundred shapes and kinds. In peaceful life they follow the citizen from the plastic toys put into his cradle to the molded plastic coffin in which he is lowered into his grave.

RESEARCH pays in hard, cold cash, Eugene Ayres of the Gulf Research and Development Company told the meeting of the American Chemical Society recently. He explained a numerical yardstick which he has developed, which gives an estimate of the differences in costs between industrial processes put into operation without waiting for preliminary experimentation and those that are given the benefit of research in laboratory and pilot plant, together with proper patent procedures, before they are strated. If a given industrial problem is carried through all three steps, or research, patent procedures and pilot plant experiments, the total cost of "make-ready" is considerably less than half that involved in rushing into full production without the preliminary steps. How necessary the pilot-plant stage is also shows up in the table. With laboratory research and patent procedure, but omitting pilot plant, the costs were substantially greater than those of complete preparation, though still substantially less than those of no preparation at all. Mr. Ayres cited the case of a company that found it necessary to go into the manufacture of a new chemical in a hurry: "There were no large-scale precedents for this operation, but two good process ideas were offered by the Research Department. Because of the emergency, it was decided to commercialize one idea without any research, while the second idea was carried in orderly fashion through laboratory and pilot plant. Despite the delay occasioned by months of research, the second idea resulted in a smoothly operating plant before the first and at much lower development cost. The first idea was then sent back to the Research Laboratory and a year later superceded the second."—FRANK THONE.

NOT just his brain, but a pilot's teeth as well, may "black out" when he pulls out of a power dive. The suggestion is made by Capt. Herbert J. Lipson, M.C., U.S.A., and Dr. S. G. Weiss, Muskogee, Oklahoma, dentist, in a report in the *Journal* of the American Dental Association. The centrifugal force which pulls the blood away from the pilot's brain, causing the familiar "black out" symptoms, would also pull the blood out of the pulp of his teeth. The absence of any recoil mechanism in the "hard, unyielding wall of dentin" surrounding the tooth pulp makes it unlikely that recovery from a "black out" in the tooth would be "so efficient or so nearly complete as in the brain." Permanent damage or death of the tooth might result. Extreme cold at high altitudes and the "bends" to which aviators as well as divers are subject might also cause injury of the tooth pulp.