



Hughes Aircraft Company

SYNTHETIC RUBY AMPLIFIES LASER'S INTENSE LIGHT—*Dr. Theodore H. Maiman, while working at Hughes Aircraft Company, looks into the heart of the laser (light amplification by stimulated emission of radiation), a scientific achievement that in an extraordinarily short span of years has become an exciting new instrument for scientific research. The tightly packed atoms in the ruby are excited by light which they amplify into an intense parallel beam.*

feeding of atomic power into the power lines of the nation may seem to be a slow process. But year by year more nuclear furnaces are placed in operation, and in another decade and a half a significant share of the energy utilized by the nation will come from the fissioning of atoms rather than the burning of fuel.

During 1964, there will be increased attention to atomic power reactors which, as they generate energy, will also convert into fissionable material the kind of uranium that can not fission and thus cannot now be utilized for power generation. This will allow the addition to our potential atomic resources of the great stores of uranium that are available in the United States and in the rest of the world.

The capturing for peaceful purposes of the reaction of the hydrogen and thermonuclear bomb is long overdue. The conversion of light elements, like forms of hydrogen, into heavier elements is a fusion process that releases immense quantities of energy. When this reaction is tamed and slowed down, these atomic transformations will be available for power purposes.

When the United States and the other atomic nations of the world gather at the end of August for the third United Nations International Conference on the Peaceful Uses of Atomic Energy at Geneva, there may be reports of progress in the development of thermonuclear energy, not for war but for peace.

Another great hope for the utilization of atomic energy has been achieved more slowly than it had been expected. This is

the use of radiation from the waste by-products of atomic power production for the pasteurization and the preservation of food. At Gloucester, Mass., in late summer a pilot plant for the pasteurization of seafood by radiation is to be completed. This may make it possible to deliver fresh fish to housewives without going through the process of freezing, canning or drying.

Without sending humans to the other planets, much information about conditions upon them is being gathered by sophisticated instruments that convert what they observe in their space travels into signals that can be received on earth. Space probes will travel closer to the planets Venus and Mars than human beings for several decades. Spying upon the planets will continue during the year since visits by rockets to the vicinity of the planets are on the programs of both the United States and Russia.

Life on Other Planets?

No one expects to find life like ours on any planet of the solar system. It is an open question as to whether there is hope that intelligent beings do exist elsewhere in the universe, even upon earth-like satellites that are presumed to exist attached to some of the billions of stars like our sun in our own and other galaxies. While there will be little publicity during the coming year, astronomers will continue to be alert for any indication of signals, like radio waves, of intelligence existing in other parts of the universe.

Because it is the time of least activity upon the sun in its cycle, 1964-65 are the International Years of the Quiet Sun, when from Antarctica and other parts of the world there will be special observations of sunspots, sun flares and other manifestations that affect the earth so materially.

There will be new "alerts" of sudden sun effects in the ionosphere modifying radio and wireless communications. Just as the successful International Geophysical Year brought nations together in research and added to our knowledge of the earth, so this special solar observation period is expected to add new knowledge.

An increase in the study of vibrations of the earth is made possible by a great proliferation of earthquake-measuring instruments which were spread over the globe because of the need to detect atomic explosions as a part of our defense effort. There will be the beginning of an extended effort to predict earthquakes by scientific methods.

Simplicity in Atom

Those who are studying the interior of the atomic nucleus are bringing simplicity again to the array of so-called fundamental particles. There seems to be growing a consensus of opinion which erases the distinction between "elementary" particles and other particles. The number, when one includes the resonances and the old system of counting, is up somewhere near a hundred now.

Great super atom smashers to create energy as high as one thousand billion electron volts and costing billions of dollars will receive consideration and perhaps authoriza-

tion during the year. These research instruments are needed to understand the fundamentals of matter and solve the mysteries of nuclear particles. From their use in future decades will come discoveries that we can now only dimly imagine but which may rival our atomic and space programs.

Primary electrons in the cosmic rays will be further investigated for the relative fluxes of positive and negative electrons. The relative amounts of helium isotopes three and four in cosmic-ray helium will be elucidated. New attention will be focused on "relativistic astrophysics," and especially on the collapse of supermassive "stars," as heavy as a million solar masses, believed to be a prime source of cosmic rays.

Ways of changing the weather and producing rain will be tested to see whether a practical method has been found in the modifying of cumulus clouds over the tropical oceans. Use of weather satellites and computer processing of complex and voluminous weather observations will continue both experimentally and practically to increase the accuracy and the range in time of weather forecasts throughout the world.

The lasers and masers which concentrate light and electronic energy into beams have had an extraordinarily rapid development and their applications to industry as well as scientific research will continue during the year.

Educational Renaissance

As part of the renaissance in educational methods and the continuing improvement in scientific literacy resulting from cooperation of scientists and teachers, there will be increased attention to the kind of education our children receive, the subject material taught and the methods of teaching in all of the school grades from kindergarten to the end of high school.

Because of the better preparation of high school graduates through courses in the new mode, particularly in science, colleges will continue to change their freshman studies to take advantage of the better preparation of their entering students.

The New York World's Fair will present an array of industrial exhibits explaining science and technology to the millions of visitors. The U.S. Atomic Energy Commission will have displays directed particularly to children.

President Kennedy just a month before his assassination told the National Academy of Sciences at its centennial that "the future is bright," that "man is still master of his own fate" and that the future "can be certain." He stressed the need of continuing financial backing for fundamental research in the life sciences, the physical sciences, the social sciences, on natural resources, on agriculture, and on protection against pollution and erosion. He saw science giving mankind a new opportunity for moral discipline as well as intellectual growth. He was convinced that the power of science would strengthen our nerve and will while it added to our knowledge.

In this spirit the great exploration of nature and man pushes on into the future, not just in the next twelve months but for the decades ahead.

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