NUCLEAR PHYSICS

From Now On: The Atom

A law which will apply to the universe and to the submicrocosmos is in the offing. New concepts for the study of the atom will be introduced.

By WATSON DAVIS

Twentieth in a series of glances forward into science.

➤ THERE really are "two worlds" among the atoms. The laws that govern the universe down to the fringes of the atoms themselves do not hold good in the hearts or nuclei of the atoms.

No puzzle is more troublesome just now than to try to figure out the action within this terrifically concentrated atomic core, made up of protons and neutrons. An assorted variety of other particles, called mesons, appear and disappear in nuclear collisions.

Just visualizing the atom is a strain upon the imagination. Suppose it is enlarged a billion times. The empty space in which the electrons roam would be about the size of a basketball. The familiar idea is that these electrons are like planets in a solar system. The nucleus, or core, would be a tiny grain of sand. Yet the bulk of the matter of the atom—and the universe—is in the nuclei, for each proton and neutron is nearly two thousand times the mass of an electron. There are in general as many electrons in the outer part of the atom as there are protons within. This balances the charges —positive for the protons and negative for the electrons.

The neutrons are electrically impartial, unattracted by matter. Theoretically they go on for immense distances once they get started, and almost all matter is "transparent" to them. The neutrons are the trigger particles of the uranium-plutonium fission atomic bombs. They explode a fissionable atom when they hit it. They start the action that changes mass into energy. That is one of the reasons that such attention is being paid to them.

Containing the bulk of the mass of the universe, the nucleus is the prime atomic powerhouse. Immense particle accelerators, flinging fragments of atoms at energies of billions of electron volts, are being built to attack it and learn its actions and secrets. Immensely curious about the practical as well as the theoretical results of such experiments, the Atomic Energy Commission is investing millions of dollars in such atom smashers, each with a special kind of job.

The cosmic rays have energies higher than those produced by any machine now building and any man can hope to build. Scientists, with aid of balloons and high places, arrange for thousands of photographic plates to be exposed to catch infrequent but revealing atomic smashes.

Some of the most advanced mathematical physics is directed toward the problem of the nucleus—the "core" problem of modern physics. To a non-mathematician what is written in formulae is unreadable. The theory is usually beyond most experimental physicists.

There is quantum electrodynamics which is concerned with the interaction of the electron, the particle of electricity, with radiation. This idea stems from Dr. P. A. M. Dirac, modern English physicist, and works out well, but the older Maxwell theory of the nineteenth century considers radiation, including the electron, as waves, and it too works. Getting such divergent theories together is the task of modern mathematicians and physicists.

For the future, you may expect:

A. New particles that will be considered "fundamental" or "elementary" in the sense that they have existences, no matter how fleeting in the nucleus of atoms. These may be more mesons, entities that seem to "play" catch, as one scientist put it, among the more lasting protons and neutrons.

B. The larger atom-smashers now building with their immense energies may so explore the heart of matter that the way the nucleus is put together will be better understood, bringing the possibility of more atomic transformations of practical importance.

C. A mathematical concept or law that will apply to the universe as a whole as well as to the submicrocosmos of the atom will be worked out.

Science News Letter, August 12, 1950

ASTRONOMY

"Shooting Star" Month

➤ THIS month is one of the best months of the year to look for "shooting stars" flashing across the night sky.

This is because the Perseids, the most conspicuous and dependable of the annual meteor showers, are visible during the first two weeks in August. The rate of seeing these brilliant "tracer bullets" from space increases slowly to Aug. 12, then falls off rapidly.

Most of the meteors will appear to radiate from the constellation of Perseus which rises in the northeast about midnight.

It is expected that about 50 "shooting stars" per hour can be seen on the night of Aug. 12 after midnight. Throughout the year the average for a single observer under the best conditions is ten an hour.

Since any one person's field of view is limited, there are actually many millions every night visible over the entire earth's surface. Smaller meteors, not visible to the naked eye, would considerably increase this total.

This year, fortunately, excellent observing conditions will prevail for the height of the shower. New moon occurs on Aug. 13 in the United States, and therefore the moon will not be visible on Aug. 12.

The frequency of seeing meteors increases after midnight. The reason that more can be seen after midnight is that in the evening we are on the following side of the earth with respect to its revolution. We are, therefore, protected from the meteors, except those that overtake us.

In the morning we are on the forward side fully exposed to the bombardment from space.

Although these meteors are actually moving in parallel paths, they will seem to come from a point, because of the perspective. The same effect is given, for instance, by far-away railroad tracks that seem to converge to a point in the distance.

Meteors are solid, swiftly moving bodies, fused and mostly consumed in their flight through the upper atmosphere. Their trails are of very short duration, but their trains, hollow cylinders of phosphorescent expanding gases, are visible from a few seconds to as much as half an hour.

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On This Week's Cover

➤ THE new jet propulsion laboratory which has recently gone into operation at Beacon, N. Y., is believed to be the first large industrial jet laboratory to be financed entirely from private funds.

On this week's cover of SCIENCE NEWS LETTER, exhaust gases from gas turbine combustion, traveling at speeds of 1,000 feet per second and reaching temperatures of 1,600° Fahrenheit, turn exhaust pipe into brilliant cherry red color in nighttime jet research. Specially constructed quartz windows permit the scientists to study the combustor interior.

The new laboratory, owned by the Texas Company, can be used to test not only petroleum components but a wide range of organic and inorganic chemicals which possess remarkable power characteristics.

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