11

Paradox in the Nucleus

When forty-six years ago an obscure Berlin mathematician by the name of Albert Einstein stated that energy and matter were the same, clear thinking people all over the world scratched their heads and decided another professor was ready for the insane asylum. Just how sane Albert Einstein really was demonstrated itself on a certain morning in the New Mexico desert. Everyone knows the official account of how a mushroom-shaped cloud rose for miles into the sky and how the explosion of a few pounds of uranium was thousands of times more powerful than blasts of T. N. T. The blast woke from their slumber many of those people who scratched their heads forty-six years ago; it opened to mankind the first view of a new age.

Although much has been accomplished in those forty-six years in fields of research and practical development, many questions and problems still confront the scientist today. There is in the atomic theory an apparent contradiction which has bothered physicists for a long time already. It is one of those contradictions which are naturally incurred in accepting any radically new theory. It deals with forces acting in the atomic nucleus. We believe the atomic nucleus to be like the center of a miniature solar syatem consistinig of electrons which rotate about the nucleus much as the planets whirl about the sun. This nucleus is the contradiction. We know that it consists of positively charged particle, particles which ordinarily would repel each other with tremendous force. The natural conclusion

to be drwwn from these facts is that some force of which we are ignorant is reconciling these factors.

The first possibility to be considered is that the force of gravitation is powerful enough to bind the elements of the atomic nucleus. The main argument to support this line of thought is the fact that the force of gravitation increases inversely as the square of the distance between two objects. This possibility becomes very real when one considers the the minuteness of the distances involved. On the other hand gravitation, whose force would be increased tremendously because of the small distances involved, might be lessened by the extremely small mass of the bodies involved.

Whatever merits this theory may have, if it is correct its implications are incalculable. It has been proved in recent years that the mass of the combined nucleus is much less than the mass of the neutrons and protons of which it is composed. If then adhering to our hypothesis we assume that the binding force is gravitational, we are logically led to the conclusion that the force of gravitation is transmutable into matter and vice versa.

What new realms of thought that statement opens! This force of gravitation is the same force that keeps all matter bound to the earth as with an iron chain, the same force that keeps the mountains from flying out into space and the earth from leaving its orbit. It makes a stone to fall and draws the ocean out in tides. When we say the that matter and gravitation can be changed into each other we are implying that, for instance,

the mass of a rock falling to earth is less when it hits the ground than when it started falling. We are saying, in other words, that part of the weight of the rock changed to energy as it fell. We have long known that when a smaller body moves toward a larger the larger also moves toward the smaller. In effect the motion is only relative. Therefore we might say that the earth was falling toward the rock as well as the rock to earth. Then we must assume that the earth also loses part of its weight as the two bodies approach each other. Of course the amount of matter lost by either body is so incalculably small that this phenomenon would be of only theoretical value at the present time. Nevertheless any thinking person can see how extensive are the implications of this idea.

The second viewpoint from which the question can be seen is quite different. It is, just as the first, a suggestion which is worth investigation.

There is still the possibility that there is some property of the nucleus not associated with mass which scientists have not yet discovered. It is extremely difficult to say what properties such a substance might have, but it should not be forgotten that scientists are still taking into account that intangible something, the ether.

Today only too little is known about the ether. As a matter of fact its existence has not even been directly proven. The idea of the ether is only a hypothesis to fill a very important gap in our knowledge. For many years it has been known

that radio, heat, light, and X-ray waves are all of the same nature and that the only difference between them lies in their frequency. Everyone is familiar with the way in which electromagnetic waves trvel even through a vacuum. And even though the theory of electromagnetic waves itself is rather complicated, it is easy to understand why there must be something to transmit these waves. This something we call the ether, knowing nothing of its properties except that it has no weight. Such a substance, then, might have unusual effects upon the nucleus of the atom. Even though our idea of the ether is at the present time very vague, it would be wrong to forget it entirely.

The third and last suggestion is that we have not as yet subdivided the atom into its constituent parts. This belief is not completely new; even before the momentous discoveries of recent months such a possibility was discussed. How much of the idea rests on scientific fact and how much on conjecture is difficult to determine, but certainly the idea is not wholly unfounded. The rapidity with which new atomic particles are being discovered makes this theory all the more probable.

Only a few years ago it was generally believed that the atom consisted of electrons and protons only. Then, the atomic theory looked relatively simple. Now we have learned that neutrons, positrons, negatrons and mesotrons also enter into the composition of the atom. It would be presumptuous to imply that these particles did not exist for experiments have proved otherwise, but inassuming them to exist and to be basic we are forsaking a dream which scientists have nurtured ever since men started thinking, that all matter is composed of indivisible

particles everyone of which is exactly like every other. The Greeks called these particles atoms, for in Greek a-tom means indivisible. Men thought that the final division of matter had been found; they have thought that in almost every period of their history. Now as simple theories once more become inadequate to fully explain the phenomena men see, perhaps the time is once again right for man to carry the subdivision of matter one step further into the mysteries of the atom.

There is, however, one serious danger in this manner of thinking. For having once accepted the myriad dividions of matter the mind is prone to think in terms of the infinite rather than the finite. The human mind cannot, for instance, comprehend the number of atoms in a drop of water. It can only rationally interpret that number, and in so far as practical thought is concerned, we can understand no difference between that number and infinity. It is important to recognize that no number and no subdivision, however small, is infinte. Infinity is like a shadow, always just beyond. It is vital, then, that we base our hopes and ideas on a scientific rather than on a metaphysical basis.

It is just as vital and perhaps even more so, that men today and especially scientists should base their thinking on more than just cold reasoning. Science, and with it mankind, has incurred an ethical responsibility of unimaginable importance. As he continues resolutely to search the atom, the scientist must hope work and pray that his toil and his labors might serve not

to destroy humanity but to enrich it and to lift it to yet higher levels of civilization and culture. To that end and to that end alone must he dedicate his life and his resources, physical, mental, and spiritual.

THE ATLANTIC MONTHLY

8 ARLINGTON STREET

BOSTON 16

May 27, 1946

Dear Mr. Meyer: -

The Atlantic congratulates you! Your essay, PARADOX IN THE NUCLEUS, has been awarded the Prize in the 1945-1946 Atlantic Essay Contest for High School and Private School Students.

We have already sent congratulations to your instructor, Mr. Domincovich, to whom we have sent the comments and the criticisms of the judges of the contests. The judges liked your essay, choosing it first from the 252 essays entered in the Contest.

The Atlantic sends you the prize enclosed with warm good wishes for your future success and great happiness.

Cordially yours,
THE ATLANTIC MONTHLY COMPANY
T. S. Fitzpatrick
Circulation Manager

Mr. Ernst Jochen Meyer
c/o Mr. H. A. Domincovich
Germantown Friends School
Coulter Street
Philadelphia 44, Pennsylvania

P.S. - The announcement will be published in the July Atlantic. A special copy will be sure to go to you from the first copies off press. - TSF