Richard feynman: there's plenty of room at the bottom

Describe his perspectives, its major points and its implications.

The physicist Richard Feynman given a lecture at American Physical Society on December 29, 1959 named “ There’s Plenty of Room at the Bottom”. This article was very different from the other commonly written topics on physics at that time. These days this lecture is commonly mentioned due to its extraordinary imaginative power. In this article Feynman predicted nanotechnology as an entire innovative field and explained the prosperity of innovatory technology advancements and applications such as very high density data storage media and very tiny mechanical devices would be practicable, with many improvements until ultimately essential physical limits at the atomic scale become applicable (Breitfelder). Feynman asked in his lecture to envisage a smallness contest in which we manage to write on a pinhead. Also he stated the techniques to read and write on pinhead. Feynman also talked about miniaturization of computers which is what exactly happening today; at the time of his lecture computers were very big. Feynman measured the opportunity of direct management of individualatomsas an extra powerful form of artificialchemistrythan those used at the time. Feynman considered very interesting implications of a general ability to control substance on an atomic scale. He was mainly concerned in the potential of smallcomputers andmicroscopeswhich could see things very small than is likely withscanning electron microscopes.

Before Feynman given this speech there was very limited information of nanotechnology exists as he stated there is lot more research and experiments need to be done. However, he described various aspects of this technology and some practical examples of how to achieve large things at

small scale. It includes writing very small text (for example the complete 24 volumes of the Encyclopaedia Britannica on the top of a pin), small computers (such as wire) and swallow the surgeon (very tiny robot which can go inside a person and examine him internally).

In this article, Feynman asked some questions (like how do we *write* small?) and he presented the answers for these questions in very significant manner. As he described there was no standard technique to write on such a small scale but it is not impossible. The article also explained the solution of small scale writing using techniques available to engineers in 1959. It was to turn round the lenses of the electron microscope in order to shrink and to enlarge the particular text. If the source of ions sent through the reverse microscope lenses it could focus to a very tiny dot. He further stated that it’s possible to write with that spot such as we write in a TV cathode ray oscilloscope by leaving diagonally in lines, and doing an adjustment which decides the quantity of material we are going to put as we scan in lines. He further assumed that every bit of the information in all books in a library could hypothetically be transformed to digital information and can be stored like bits consisting of elements which can have only a few atoms each. These can be two different shapes to represent 0s and 1s. This would bundle much more information into a smaller space, and according to Feynman the complete contents of the world’s large libraries could fit in somewhat the size of a dust nit.

The author also presented the very different opportunity (which is the idea of his friend and graduate studentAlbert Hibbs) of “ swallowing the doctor,”. This idea involved building a little, swallow able surgical robot. This tiny

robot goes inside the blood vessel of a person and can examine the internal problem and do the surgery by itself. One tinier machine can be designed to put permanently inside the body which can assist the poorly functioning of organs. Feynman further discussed how to design such a tiny robot with giving the example of atomic energy plants.

The author’s imagination about the computers is very interesting as on one side he wanted to add more functionality to the existing computers, on another point he wanted them to be very small. Feynman stated that if we want to add more abilities to these existing large computers (which are of the size of the room) those new computers could be bigger than the pentagon’s building and some other disadvantages includes power consumption, heat generation, slow speed and too much material required. If speed of computers has to be faster, computers have to be smaller. The author recommended that very small computers could be prepared by fabricating all the required wires and components using chemical techniques, to form a little block consisting all the compulsory electronics.

Feynman also said that building useful things could be done at the atomic level, by manipulating individual atoms to arrange them however the engineer or scientist wanted . However, he discussed the problems associated with these changes such as the gravity for these little things is not appreciable. If the sizes go smaller, some of the tools would also require redesigning due to the change in the relative strength of various forces. Even ifgravitywould become inconsequential, surface tension would turn out to be more important. At the end of this article, Feynman gave two challenges and offered a prize of $1000 for the person who can accept and solve it first.

These challenges involved the construction of atiny electric motor no larger than 1/64th of an inch square and the second challenge involved the opportunity of making size of letters adequately small so that the entireEncyclopaedia Britannica can be written on the top of a pin. The information from a book page could be written on a surface 1/25, 000 smaller in linear scale. In November 1960 William McLellan of Caltech, a meticulous craftsman, achieved the solution of first challenge with a device made by hand using conventional tools and claimed the prize. These days this tiny motor is placed in the corridors of Caltech. The book challenge took longer time; it was achieved just three years before Feynman’s death in 1985 by Tom Newman, a graduate student at Stanford University, US, using electron-beam lithography. He scaled down the first paragraph of“ A Tale of Two Cities” by 1/25, 000, and calmed the second prize from Feynman (“ Feynman’s fancy”).

The field has seen remarkable achievements since then, indeed, most notably the reduction of the area of transistors in microelectronic circuits by more than a factor of 10^{7} , or of the space required to store 1 bit of information on a magnetic surface by $\approx 10^{8}$. Nanomechanical devices have seen tremendous progress, too, through impressive advances in scanning probe microscopy (“ Feynman’s fancy”).

Works Cited

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