A. Einstein
(1879-1955)

Einstein's birthday was on 14^{th} March (1949). He is generally recognized as the greatest living mathematical physicist. Of course, younger men are now making greater contributions to that subject than he has done in the last ten years, but no one has yet equalled his earlier work. He is best known for his work on relativity. But if he had never written a line on the subject, he would still be regarded as a scientist of the first rank.

The quantum theory was founded by Planck, but it was Einstein who made the simplest and probably the most universally valid statement about it, namely that when matter emits or absorbs light, the energy is transformed in single units. And the size of the unit is proportional to the frequency of the light. The energy of blue light is given out in bigger packets than that of red light, and that of red light in bigger packets than that of infra-red radiation, which we cannot see, but can feel as heat. That is why when we heat a metal it gives out red light before it gives out white. At a red heat some atoms have enough energy to produce red light, hardly any have enough to produce green or blue, which must be added to the red to make white.

However, his work on relativity was even more important. Let us try to explain it. Our «common sense» view is that everything has a definite shape and size, that an event happens at the same time as a class of other events, and so on. What is more, some people seem to think that any denial of this view is idealism.

Let us take a simple example to show that our common sense view won't work. I drop a parcel in a steadily moving train. To me it seems to fall in a straight line, or nearly so. To you, standing on the platform as the train goes past, it seems to move in a curve called parabola, the descent becoming steeper and steeper as time goes on. If the earth were fixed, you would perhaps be right. But as the earth is moving too, there is little to choose between the two versions.

Does that mean that the parcel has no real track, and is only something in our minds? Not a bit, says Einstein; you can give an account of the parcel's movement which will be the same for all observers. So it is probably a considerable step nearer to reality than either my account or yours. But to give such an account we have to revise our accounts of space and time. There is an interval between any two events, and there are three sorts of intervals.

The first sort of interval can be interpreted by me as entirely one of time, that is to say I may think two events happened at the same place and different times. But if you are moving relative to me you will say they happened at different places and different times.

The second sort of interval can be interpreted as entirely one of space. That is to say I think two events happened at the same time in different places. But to you they may seem to have happened at different places and also at different times.

Common sense, rather reluctantly, recognizes the first kind of relation between events. We all agree that if London is spinning round the earth's axis, two events in the same room at an hour's interval can be said to be hundreds of miles apart. But it took Einstein to see that «at the same time» was just as relative to the observer as «in the same place». There is a third kind of interval between events which all observers will agree are separated both in space and in time.

Of course if he had stopped there his work would merely have been negative. But he was able to describe a framework of space time which was the same for all observers, though they would interpret it a little differently. This at once cleared up a lot of contradictions in physics. People had tried to measure how fast the earth was moving through space by measuring the speed of light at different times of year, and had found no difference. If Einstein is right, they could not hope to find one, because space has no being of its own apart from matter.

I think most physicists are agreed that Einstein's theory works very exactly so long as the two observers are in uniform motion relative to one another, like a man on a platform and a man in a steadily moving train. But things are not so simple when the speed of one relative to the other is changing, for example when the train is accelerating or slowing down. Everyone knows that acceleration generates forces, for example an accelerating or decelerating train seems to slope even when the track is flat. Einstein said that the man in the moving train who thinks its floor is off the straight has a perfect right to his opinion, and on this basis he predicted that gravitation and acceleration would have similar effects.

In particular light should be bent by a very strong gravitational field. This prediction was verified by Eddington during an eclipse of the sun in 1919. What is more, it was bent to the extent which Einstein had predicted. More and more other predictions came off. Einstein said that a body in motion relative to a balance was heavier than the same body at rest. So is a body with potential energy. You watch weighs more when wound up than when run down. The amount of energy in a watch is much too small to weigh by methods at present available. But the amount of energy in a large number of radioactive atoms is enough to make them weigh distinctly more than the products formed when they split up. And this energy has been weighed.

However, the general theory of relativity, that is to say the theory applied to systems whose parts are not in uniform motion relative to one another, is not complete. When one attempts to apply it to events which are very far apart in space or time it yields results which are probably incorrect. There is nothing surprising in this. One only approaches the truth by steps. Einstein made a very big step, but he is much too good a physicist to think that he has made the last one.

Of course Einstein's theories can be interpreted idealistically, and he has sometimes done so himself, though never completely. There is a measure of truth in the idealistic interpretation. The idealists say that what we call the material world only exists in our minds. A follower of Einstein would say something like this. Events, such as human births and deaths, chemical changes, or solar eclipses, are real enough. But the framework of the space and time, into which we try to fit them, is partly our own construction. There is a real set of relations between events. But different people interpret it in different ways. I say the parcel fell in a straight line, you say it fell in a curve. Each of us was giving a one-sided account of a track in space-time.

Reality is more complicated than we think. But that does not mean that things aren't real. On the contrary one might say they are more real than any isolated observer could have imagined. Only by the social act of comparing the experiences of different observers can we make the important step towards truth which Einstein was the first to make.

Questions

1. What is Einstein best known for?
2. Try to explain in a simple way the space-time relationship of events.
3. Mention some of Einstein's scientific predictions.
4. Who founded the quantum theory?
5. How do you understand the theory of relativity?
6. Find conditional sentences in the text.
7. Why can theories of Einstein be interpreted idealistically?