Albert Einstein 3 Essay, Research Paper

Albert Einstein

Albert Einstein was born in Ulm, Germany on March 14, 1879, and died in 1955.

He was an American physicist and Nobel Laureate, also known as the creator of

the special and general theories of relativity and for his hypothesis concerning

the particle nature of light. He is perhaps the most well known scientist of

the 20th century.

Albert Einstein spent most of his youth in Munich, Germany, where his family

owned a small shop that manufactured electric machinery. He did not talk until

the age of seven, but even as a youth he showed a brilliant curiosity about

nature and an ability to understand difficult mathematical problems. At the age

of 12 he taught himself geometry.

Repeated business failure led the family to leave Germany for Milan, Italy,

when he was 15 yrs old. He then used the opportunity to withdraw from school.

He spent a year with his parents in Milan, and when it became clear that he

would have to make his own way in the world, he finished secondary school in

Arrau, Switzerland, and entered the Swiss National Polytechnic in Zurich.

Einstein often cut classes and used the time to study physics on his own or to

play his violin. He passed all of his tests and graduated in 1900 by studying

the notes of a classmate. His professors did not think highly of him and would

not recommend him to a university.

For two years Einstein worked as a tutor and substitute teacher. In 1902 he

got a position as an examiner in the Swiss patent office in Bern. In 1903 he

married Mileva Maric, who had been his classmate at the polytechnic. They had

two sons but eventually divorced. Einstein later remarried.

In 1905, Einstein received his doctorate from the University of Zurich for a

theoretical dissertation on the dimensions on the dimensions of molecules. He

also published 3 papers of central importance to the development of the 20th

century physics. In the first paper, Brownian Motion, he made a significant

prediction about the motion of the particles that are randomly distributed in a

fluid. These predictions were later confirmed by experiments.

The second paper on photoelectric effect, contained a revolutionary hypotheses

concerning the nature of light. Einstein not only proposed that under certain

circumstance’s light can be considered as consisting of particles, but he also

hypothesized that the energy frequency of the radiation. The formula for this

is E = hu, where E is the energy of the radiation. And h is a universal

constant known as Planck s constant. And u, is the frequency of the radiation.

This offer that the energy contained within a light beam is transferred in

individual units. Virtually no one accepted Einstein s proposal. In fact, when

the American physicist Robert Andrews Millikan experimentally confirmed the

theory almost a decade later, he was surprised and somewhat troubled by the

outcome.

Einstein, whose prime concern was to understand the nature of electromagnetic

radiation, subsequently urged the development of a theory that would be a fusion

of the wave and particle models for light. Again, very few physicists

understood or were sympathetic to these ideas.

Einstein s third major paper in 1905, On the Electrodynamics of Moving

Bodies, contained what became known as the special theory of relativity. Since

the time of the English mathematician and physicist Sire Isaac Newton, had been

trying to understand the nature of matter and radiation, and how they interacted

in some unified world picture. The position that mechanical laws are

fundamental has become known as the mechanical world view, and the position that

electrical laws are fundamental has become known as the electromagnetic world

view. Neither approach, is capable of providing a consistent explanation for

the way radiation (light for example) and matters interact. When viewed from

different inertial frames of reference, an interaction viewed simultaneously by

an observer at rest and an observer moving at uniform speed.

In spring of 1905, after considering these problems for ten years, Einstein

realized that the basis of the problem lay not in a theory of matter but in a

theory of measurement. At the heart of his special theory of relativity was the

realization that all measurements of time and space depend on judgments as the

whether two distant events occurred simultaneously. This led him to develop a

theory based on two postulates. The principle of relativity, that physical laws

are the same in all inertial reference systems, and the principle of the

invariance of the speed of light, that the speed of light in a vacuum is a

universal constant. He was thus able to provide a consistent and correct

description of physical events in different inertial frames of reference without

making special assumptions about the nature of matter or radiation, or how they

interact. Virtually no one understood Einstein s argument.

The difficulty that others had with Einstein s work was not because it was too

mathematically complex or technically obscure, it was rather from Einstein s

beliefs about the nature of good theories and the relationship between

experiment and theory. Although he maintained that the only source of knowledge

is experience, he also believed that scientific theories are the free creations

of a finely tuned physical intuition and that the premises on which theories are

based cannot be connected logically to experiment. A good theory, is one in

which a minimum number of postulates is required to account for the physical

evidence. This feature of all Einstein s work, was what made his work so

difficult for colleagues to comprehend, let alone support.

Einstein did have important supporters, however, his chief early patron was the

German physicist Max Planck. Einstein remained at the patted office for four

years after his star began to rise within the physics community. He then moved

rapidly upward in the German speaking academic world. His first academic

appointment was in 1909, at the University of Zurich. In 1911, he moved to the

German speaking university at Prague, and in 1912, he returned to the Swiss

National Polytechnic in Aurich. Finally, in 1913, he was appointed director of

the Kaiser Wilhelm Institute for Physics in Berlin.

Even before he left the patent office in 1907, Einstein began work on extending

and generalizing the theory of relativity to all coordinate’s systems. He began

by enunciating the principal of equivalence, a postulate that gravitational

fields are equivalent to accelerations of the frame of reference. For example,

people in a moving elevator cannot decide whether the force that acts on them is

caused by gravity or by a constant acceleration of the elevator. The full

general theory of relativity was not published until 1916. In this theory the

interactions of bodies, which had been ascribed to gravitational forces, are

explained a the influence of bodies on the geometry of space-time.

On the basis of the general theory of relativity, Einstein accounted for the

previously unexplained variations in the orbital motion of the planets and

predicted the bending of starlight in the vicinity of a massive body such as the

sun. The confirmation of this latter event during an eclipse of the sun in 1919

became a media event, and Einstein s fame spread worldwide.

For the rest of his life Einstein devoted considerable time to generalize his

theory even more. His last effort, the unified field theory, which was not

entirely successful, was an attempt to understand all physical interactions,

including electromagnetic interactions and weak and strong interactions, in

terms of the modifying of the geometry of space-time.

Most of Einstein s colleagues felt that these efforts were misguided. Between

1915 and 1930 the mainstream of physics was in developing a new conception of

the basic character of matter, known as quantum theory. This theory contained

the feature of wave-particle duality (light exhibits the properties of a

particle, as well as of a wave) that Einstein had earlier urged as necessary, as

well as the uncertainty principle, which states that precision in measuring

processes is limited. Additionally, it contained a novel rejection, at a

fundamental level, of the notion of strict causality. Einstein, however, would

not accept such notions and remained a critic of these developments until the

end of his life. God , Einstein once said, does not play dice with the

world .

After 1919, Einstein became internationally renowned. He accrued honors and

awards, including the Nobel Prize in physics in 1921, from various world

scientific societies. His visit to any part of the world became a national

event; photographers and reporters followed him everywhere. While regretting

his loss of privacy, Einstein capitalized on his fame to further his own

political and social views.

During World War I he was one of a handful of German academics willing to

publicly decry Germany s involvement in the war. After the war his continued

on. Being supported by pacifist and Zionist goals made him the target of

vicious attacks by anti-Semitic and right wing elements in Germany. Even his

scientific theories were publicly ridiculed, especially the theory of

relativity.

When Hitler came to power, Einstein immediately decided to leave Germany for

the United States. He took a position at the Institute for Advanced Study at

Princeton, New Jersey. While continuing his efforts on behalf of world Zionism,

Einstein renounced his former pacifist stand in the face of the awesome threat

to humankind posed by the Nazi regimen Germany.

In 1939 Einstein collaborate with several other physicists in writing a letter

to President Franklin D. Roosevelt, pointing our the possibility of making an

atomic bomb and the likelihood that the German government was embarking on such

a course. The letter, which bore only Einstein s signature, helped lend urgency

to efforts in the US to build the atomic bomb, but Einstein himself played no

role in the work and knew nothing about it at the time.

After the war, Einstein was active in the cause of international disarmament

and world government. He continued his active support of Zionism but declined

the offer made by leaders of the state of Israel to become president of that

country. In the US during the late 1940 s and early 50 s he spoke out on the

need for the nation s intellectuals to make any sacrifice necessary to preserve

political freedom. Einstein died in Princeton on April 18, 1955.

Einstein s efforts in behalf of social causes have sometimes been viewed as

unrealistic. In fact, his proposals were always carefully thought out. Like

his scientific theories, they were motivated by sound intuition based on a sharp

and careful assessment of evidence and observation. Although Einstein gave much

of himself to political and social causes, science always cam first, because, he

often said, only the discovery of the nature of the universe would have lasting

meaning.

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