

# Albert Einstein

~~Without~~ Without ~~us~~ an institute, a laboratory, ~~and~~ a staff of assistants, calculating machines, or other paraphernalia of modern research, Albert Einstein ~~has~~ <sup>who</sup> ~~has~~ <sup>who</sup>

~~today~~ <sup>celebrates his</sup> 75<sup>th</sup> birthday ~~and~~ <sup>has</sup> ~~achieved~~ <sup>brought me of</sup> ~~the~~ <sup>about</sup> ~~greatest~~ <sup>a</sup> ~~great~~ <sup>comprehension of</sup> ~~revolution~~ <sup>outlook</sup> ~~in~~ <sup>relation to</sup> ~~man's~~ <sup>of</sup> ~~outlook~~ <sup>to</sup> ~~the~~ <sup>of</sup> ~~universe~~ <sup>and</sup> ~~and~~ <sup>different to a</sup> ~~the~~ <sup>physicist, astronomer, or scientifically influenced field other than</sup> ~~world~~ <sup>only physics and astronomy, but also philosophy</sup> ~~looks as~~ <sup>What is</sup> ~~if~~ <sup>and</sup> ~~is~~ <sup>deeply influenced not</sup> ~~physicist, astronomer, or scientifically influenced field other than~~ <sup>only physics and astronomy, but also philosophy</sup> ~~What~~ <sup>from what it</sup> ~~is~~ <sup>looked before</sup> ~~before~~ <sup>after</sup> ~~1905~~ <sup>1905</sup> Einstein's great discoveries

~~were~~ <sup>made</sup> ~~in~~ <sup>in</sup> ~~1905-1915~~ <sup>1905-1915</sup>, as ~~the~~ <sup>the</sup> ~~world~~ <sup>world</sup> ~~would~~ <sup>would</sup> ~~it~~ <sup>it</sup> ~~did~~ <sup>did</sup> ~~before~~ <sup>before</sup> ~~and~~ <sup>and</sup> ~~after~~ <sup>after</sup> Copernicus has removed the earth from its central position ~~in~~ <sup>in</sup> ~~the~~ <sup>the</sup> ~~universe~~ <sup>universe</sup>, ~~What~~ <sup>is</sup> ~~is~~ <sup>removable</sup> ~~although~~ <sup>although</sup> ~~this~~ <sup>this</sup> ~~revolution~~ <sup>revolution</sup> ~~is~~ <sup>is</sup> ~~and~~ <sup>and</sup> ~~less~~ <sup>less</sup> ~~easily~~ <sup>easily</sup> ~~explainable~~ <sup>explainable</sup> ~~to~~ <sup>to</sup> ~~the~~ <sup>the</sup> ~~public~~ <sup>public</sup> - despite the immense flood of popular literature on relativity notwithstanding.

~~It~~ <sup>is</sup> ~~often~~ <sup>often</sup> ~~made~~ <sup>made</sup> ~~in~~ <sup>in</sup> ~~the~~ <sup>the</sup> ~~understanding~~ <sup>understanding</sup> ~~of~~ <sup>of</sup> ~~the~~ <sup>the</sup> ~~laws~~ <sup>laws</sup> ~~of~~ <sup>of</sup> ~~nature~~ <sup>nature</sup>, ~~acquired~~ <sup>acquired</sup> ~~by~~ <sup>by</sup> ~~means~~ <sup>means</sup> ~~completely~~ <sup>completely</sup> ~~disinterested~~ <sup>disinterested</sup> ~~in~~ <sup>in</sup> ~~all~~ <sup>all</sup> ~~practical~~ <sup>practical</sup> ~~applications~~ <sup>applications</sup> "unpractical" ~~in~~ <sup>in</sup> ~~all~~ <sup>all</sup> ~~but~~ <sup>but</sup> ~~the~~ <sup>the</sup> ~~discovery~~ <sup>discovery</sup> ~~of~~ <sup>of</sup> ~~scientific~~ <sup>scientific</sup> ~~truth~~ <sup>truth</sup>, ~~has~~ <sup>has</sup> ~~soon~~ <sup>soon</sup> ~~or~~ <sup>or</sup> ~~later~~ <sup>later</sup> ~~been~~ <sup>been</sup> ~~to~~ <sup>to</sup> ~~time~~ <sup>time</sup> ~~have~~ <sup>have</sup> ~~led~~ <sup>led</sup>, ~~in~~ <sup>in</sup> ~~due~~ <sup>due</sup> ~~time~~ <sup>time</sup>, ~~to~~ <sup>to</sup> ~~unexpected~~ <sup>unexpected</sup> ~~practical~~ <sup>practical</sup> ~~consequences~~ <sup>consequences</sup> ~~of~~ <sup>of</sup> ~~the~~ <sup>the</sup> ~~greatest~~ <sup>greatest</sup> ~~practical~~ <sup>practical</sup> ~~importance~~ <sup>importance</sup>, ~~for~~ <sup>for</sup> ~~humanity~~ <sup>humanity</sup>. ~~The~~ <sup>The</sup> ~~equivalency~~ <sup>equivalency</sup> ~~of~~ <sup>of</sup> ~~mass~~ <sup>mass</sup> ~~and~~ <sup>and</sup> ~~energy~~ <sup>energy</sup>, ~~which~~ <sup>which</sup> ~~is~~ <sup>is</sup> ~~one~~ <sup>one</sup> ~~of~~ <sup>of</sup> ~~the~~ <sup>the</sup> ~~many~~ <sup>many</sup> ~~abstract~~ <sup>abstract</sup> ~~consequences~~ <sup>consequences</sup> ~~of~~ <sup>of</sup> ~~Einstein's~~ <sup>Einstein's</sup> ~~Theory~~ <sup>Theory</sup> ~~of~~ <sup>of</sup> ~~relativity~~ <sup>relativity</sup>, ~~has~~ <sup>has</sup> ~~been~~ <sup>been</sup> ~~provided~~ <sup>provided</sup> ~~the~~ <sup>the</sup> ~~basis~~ <sup>basis</sup> ~~for~~ <sup>for</sup> ~~the~~ <sup>the</sup> ~~search~~ <sup>search</sup> ~~for~~ <sup>for</sup> ~~energy~~ <sup>energy</sup> ~~from~~ <sup>from</sup> ~~atomic~~ <sup>atomic</sup> ~~nuclei~~ <sup>nuclei</sup>, ~~which~~ <sup>which</sup> ~~is~~ <sup>is</sup> ~~the~~ <sup>the</sup> ~~most~~ <sup>most</sup> ~~important~~ <sup>important</sup> ~~fact~~ <sup>fact</sup> ~~in~~ <sup>in</sup> ~~human~~ <sup>human</sup> ~~history~~ <sup>history</sup>. Einstein

intensity but abstract mathematical become

consequences of Einstein's Theory of relativity, has been provided the basis for the search for energy from atomic nuclei, which is the most important fact in human history. Einstein

has thus become, in the public eye, the spiritual progenitor of atomic bomb and the atomic energy - although his own role in this development has been restricted to ~~the~~ writing of a single letter to President Roosevelt on 1940, drawing ~~the~~ attention <sup>of the President</sup> to the ~~possibilities~~ <sup>possibility</sup> of atomic military implications of the discovery of nuclear fission.

It is remarkable that long before this ~~letter~~ <sup>favorable</sup> Einstein atomic energy has made ~~has~~ <sup>atomic science and scientists' names</sup> ~~acquired~~ <sup>has</sup> ~~greater~~ <sup>been</sup> ~~as~~ <sup>introduced</sup> a wider public recognition, and ~~admiration~~ <sup>and</sup> ~~(and~~ <sup>a measure of</sup> ~~its~~ <sup>and</sup> ~~inevitable~~ <sup>eyes</sup> ~~counterpart~~ <sup>understanding and hatred)</sup>, ~~more~~ <sup>hardly this quiet, unassuming</sup> ~~than~~ <sup>man,</sup> any ~~scientist~~ <sup>few</sup> ~~in~~ <sup>people</sup> ~~history~~ - despite the fact that his achievements were, to this point, entirely in the field of theoretical, ~~and~~ <sup>and</sup> or even mathematical physics, and that he had always shied <sup>away</sup> ~~at~~ <sup>all</sup> publicity. When I was a student <sup>in 1925</sup> in Berlin, Einstein's lecture course on relativity was overrun by crowds which came to it as to a great public event, and Einstein had to ~~resort~~ <sup>resort</sup> to substituting ~~for~~ <sup>for</sup> his assistant, ~~a man~~ <sup>a great</sup> who suffered <sup>from</sup> ~~of~~ <sup>from</sup> megalocephalia ~~and~~ <sup>and</sup> for several lectures ~~to~~ <sup>to</sup> before ~~he~~ <sup>he</sup> ~~was~~ <sup>was</sup> ~~able~~ <sup>able</sup> ~~to~~ <sup>to</sup> ~~give~~ <sup>give</sup> ~~the~~ <sup>the</sup> ~~course~~ <sup>course</sup> ~~with~~ <sup>with</sup> ~~any~~ <sup>any</sup> ~~one~~ <sup>one</sup> ~~of~~ <sup>of</sup> ~~any~~ <sup>any</sup> ~~interest~~ <sup>interest</sup>.

has been for forty years now, one of the most widely famous public figures in the world.

Two thirty thirty years later his face is ~~not~~ <sup>not</sup> likely to be recognized by the greatest number of people all over the world.

The other great theoretical physicists who have ~~shared~~ <sup>shared</sup> with Einstein are ~~Maxwell~~ <sup>Maxwell</sup> ~~Bohr~~ <sup>Bohr</sup> ~~Schrödinger~~ <sup>Schrödinger</sup> and ~~Heisenberg~~ <sup>Heisenberg</sup> - have ~~remained~~ <sup>remained</sup> ~~by~~ <sup>by</sup> ~~scientific~~ <sup>scientific</sup> ~~interest~~ <sup>interest</sup>.

~~Einstein~~ community of the world; Einstein alone, has  
 captured the imagination of the <sup>broad masses</sup> masses, and he  
 has become the symbol <sup>for many</sup> of ~~our~~ mind, the symbol  
 of the <sup>embodiment</sup> ~~power~~ of scientific thinking, scientific ~~thought~~  
<sup>of an almost</sup> ~~superman~~ <sup>being</sup> ~~thought~~. <sup>science</sup> ~~power~~ of <sup>thought</sup> ~~scientific thought~~.

There is an <sup>instructive</sup> ~~truth~~ in this <sup>embodiment</sup> ~~symbol~~  
~~out of Einstein as the epitome of modern scientific~~  
~~of our age.~~ <sup>thought</sup> More than anyone else any other of them,  
 the "great generation" of theoretical physicists, to which  
~~he belongs~~, Einstein's ~~reputation~~ <sup>stands for</sup>  
~~the power of concentrated~~ <sup>dedicated</sup> ~~consistent~~ <sup>disciplined</sup>, ~~persistent~~, <sup>dedicated</sup> ~~thought~~. Einstein <sup>has been</sup>  
~~often~~ <sup>called</sup> called "mathematician"; in fact,  
 his present position at Princeton is that of a  
 professor of mathematics. ~~Einstein is~~, however, not  
 a <sup>great</sup> ~~mathematician~~, but a <sup>great</sup> ~~physicist~~, <sup>his thought are</sup> ~~total interest~~  
 directed <sup>at</sup> ~~his~~ in the real world, and not on mathematical  
 symbols ~~of~~ or operations, which are for him only  
~~a~~ <sup>tools</sup> ~~for~~ <sup>the</sup> recognition and formulation of the  
 basic laws of the physical world.

~~When~~ <sup>young</sup> Einstein first started thinking about these  
~~laws~~ <sup>private</sup> laws - as a <sup>young</sup> ~~patent~~ examiner in the Swiss  
 patent office - the world of physics was that of  
~~ancient~~ Euclid's geometry and Newton's mechanics - an  
 infinite expanse of space, in which material bodies

were moving, ~~according~~ <sup>with the</sup> uniformly flowing time, obeying  
 the ~~laws~~ <sup>maneuvering simple</sup> of ~~Newtonian~~ mechanics, discovered by Newton.  
 There was no absolute rest in this world, because  
 the ~~laws~~ <sup>Newtonian</sup> gave no way to distinguish between a  
 material body at rest and one in uniform straight motion.  
 However, means for this distinction seemed to be  
 available in optics. Light propagated itself with  
 a ~~definite~~ <sup>certain</sup> measurable velocity in space, quite  
 independently of the presence of material bodies;  
 should not the measurements of the velocity of light  
 in ~~two~~ <sup>different</sup> ~~opposite~~ directions reveal whether the observer  
 stands still or moves uniformly in a ~~certain~~ direction  
 in space? The famous "Michelson experiments" by  
 Michelson, the ~~prof~~ physics professor at Chicago, ~~said~~ <sup>had answered</sup> ~~showed~~ ~~said~~  
 "no" to this question. ~~Light velocity was the same~~ While they  
 tried to find ~~some~~ <sup>an</sup> answer to this startling result in the  
 frame of ~~the~~ traditional physics, Einstein thought it through  
~~to~~ fearlessly to its logical consequences, which  
 meant nothing less than a revision of our concept  
 of space, time and thus, distance and simultaneity,  
~~and establishment of~~ the velocity of light <sup>was established as</sup> as the  
~~the~~ most important natural constant, ~~the~~ <sup>was established as</sup> ~~spec~~ which  
 - a limit which the speed of material bodies can  
 approach but never reach or exceed. The  
 mass of material particles was shown to increase with

and replacement  
 of the latter  
 by a single  
 concept of  
 "space-time"

their speed, thus preventing them from ever achieving the speed of light. The equivalence of mass and energy.

Twelve years later, <sup>in 1915</sup> almost lost in the din of the first world war - Einstein - by now a professor of theoretical physics at Berlin - ~~proposed~~ <sup>made</sup> an even more revolutionary step next step in the re-interpretation of the ~~new~~ physical world. Having ~~fixed~~ <sup>first</sup> the ~~mathematical~~ <sup>classical</sup> concepts of space and time into a physical reality of space-time, he now ~~showed~~ showed that the Newtonian gravitation force - which seemed to defy ~~his~~ his "principle of relativity" ~~can be~~ original theory (designated as "special relativity" since it proclaimed the "equal rights" of a special set of observers - all ~~time~~ moving <sup>straight</sup> ~~on straight~~ <sup>and at</sup> uniform speed relative to each other), could be fitted into a ~~new~~ <sup>larger</sup> new theory of "general relativity" in which gravitation became ~~merely~~ the expression of curvature in ~~the~~ space-time around material bodies. Planets were shown to move <sup>in ellipses</sup> ~~around the sun~~ not because of a ~~mysterious~~ <sup>cur</sup> attraction force, but because space was ~~so~~ "curved" around the sun in such a way as to require this movement.

on them; and by the same token, light rays were shown to be curved when passing near material bodies. The test of this startling ~~prediction~~ <sup>prediction</sup> - possible only by observation of stars near the edge of the sun during full solar eclipses - became for the great ~~scientific~~ <sup>practical test</sup> of general relativity, and ended with its vindication.

Despite the general ~~the~~ <sup>the</sup> leaders and brilliant logic of Einstein's thinking, <sup>soon</sup> won general admiration, but of scientists; but the revolutionary conclusions, to which this logic led, frightened many of them, despite the ~~fact~~ <sup>fact</sup> many experimental confirmations of its ~~to~~ <sup>his</sup> predictions in cosmology, electronics, and spectroscopy. When the Nobel prize in physics was awarded to Einstein in 1925, it was ~~officially~~ <sup>officially</sup> ~~not~~ <sup>not</sup> in recognition of his ~~central~~ <sup>unique</sup> achievement - the theory of relativity - but in recognition of ~~his~~ <sup>another</sup> brilliant contributions ~~to these fields of theoretical physics.~~ These contributions were many and various - the explanation of the "Brownian motion," ~~the~~ <sup>the</sup> ~~theory~~ <sup>the</sup> ~~of~~ <sup>of</sup> the photoelectric effect, the quantum theory of light structure of light, the ~~best~~ <sup>best</sup> explanation of the ~~heat~~ <sup>heat</sup> capacity of bodies at low temperatures, the laws of

molecular statistics, to name ~~but~~ some of them, each enough to <sup>be made the life work of</sup> distinguish a first-rank physicist; but the major and unique achievement of Einstein remains the re-interpretation of space time and gravitation, which forms the ~~basis~~ <sup>framework</sup> on which ~~the~~ <sup>the</sup> ~~modern atomic and nuclear physics, and modern cosmology, with its~~ <sup>revolutionary concepts of a</sup> finite and expanding universe.

After Einstein has fused space, time and gravitation into a single picture frame in which ~~the laws of~~ <sup>all</sup> mechanical affairs are governed by a simple universal law, there remained in the world one type of phenomena which defied integration - the electromagnetic <sup>fields and</sup> forces, which seemed to have a life of an existence of their own, independent of the space-time-gravitation continuum. Since for thirty years, Einstein's thoughts have been riveted to the problem of a "unified field theory" which would fuse these two worlds together, <sup>and others</sup> he ~~has~~ made important progress in mathematical approximations to such a theory, but the aim of a simple physical re-interpretation of the world in such unified terms, remains unachieved.

Despite his ~~the~~ abstract theoretical character of his work, and his <sup>quiet and</sup> retiring ~~or~~ nature, Einstein always had a <sup>level of</sup> ~~great~~ interest in ~~art~~ <sup>public</sup> affairs, and has never hesitated to make his stand clear. He was liberal, world-minded, anti-militarist, ~~and even pacifist~~ in a Germany, <sup>which</sup> ~~increas-~~ingly ~~single~~ <sup>was</sup> nationalistic, ~~and then~~ <sup>first</sup> monarchist, ~~and then~~, after a short <sup>revolutionary</sup> ~~refall~~ <sup>spell</sup> ~~springtime~~ of <sup>republican</sup> ~~the~~ democracy, increasingly ~~and~~ militaristic and nationalistic and reactionary; he was a few who <sup>unwavered of his anger and</sup> ~~was~~ <sup>was</sup> ~~not~~ open in his sympathy with Jewish ~~emancipation~~ aspirations, ~~including the~~ <sup>in Europe and</sup> ~~in~~ <sup>Germany</sup> ~~or~~ <sup>latent</sup> ~~and~~ <sup>and</sup> violently re-awakened <sup>traditional</sup> antisemitism. ~~He~~ In the eyes of German reactionaries and racists, he became the symbol of ~~foreign~~ <sup>the</sup> alien. He embodied of all they hated what was hateful to them. ~~The~~ ~~for~~ ~~the~~ ~~racists~~ ~~the~~ ~~the~~ ~~mean~~ ~~relativity~~ was denounced by the ~~Lenards~~ and ~~Stark~~ as un-German; ~~the~~ <sup>Einstein's</sup> ~~his~~ books were among the first to be <sup>thrown</sup> ~~burned~~ into the Nazi book burning. ~~fire~~ <sup>after Hitler came to power.</sup> ~~the~~ ~~its~~ ~~his~~ ~~life~~ ~~might~~ ~~u~~.

The fact that he was abroad at that time might have saved him; ~~from~~ he did not return to Germany, but accepted, in 1933, a position as member of the Institute for Advanced Studies at Princeton, N.J. ~~There~~ he has lived for the last 20 years.

His life continues to be that of center around



~~unhappy, concentrated~~ consistent, untiring, ~~logical~~ <sup>frank</sup>  
~~did~~ thinking about the physical world, ~~above all,~~  
~~but also about the~~ <sup>more</sup> ~~the~~ ~~problems~~ ~~of~~ ~~man~~ ~~kind~~ ~~in~~ ~~the~~  
~~his~~ ~~he~~ ~~has~~ as years go by, he is more and  
more seldom seen away from his house ~~in Princeton~~  
~~at~~ his study at the Institute; but his interest in  
world affairs remains lively. When <sup>atomic</sup> scientists ~~have~~  
~~often~~ tried, in 1945, to impress the world with the  
necessity ~~of~~ <sup>the</sup> ~~world~~ adjusting its thinking <sup>(and policies)</sup> ~~and~~ ~~to~~  
the reality of the atomic weapons, Einstein <sup>became</sup> ~~was~~  
the natural rallying point; the "Emergency Committee  
of Atomic Scientists" gathered around him as  
Chairman ~~in Princeton~~. He ~~is~~ still hates war,

violence, militarism, <sup>and</sup> ~~of~~ suppression of freedom ~~or~~ ~~wherever~~  
~~or~~ ~~under~~ ~~any~~ ~~flag~~ ~~it~~ ~~may~~ ~~occur~~ - and ~~is~~ ~~not~~ ~~afraid~~  
~~of~~ ~~stating~~ ~~freely~~ ~~to~~ ~~express~~ ~~his~~ ~~unconcerned~~ ~~with~~  
is ~~any~~ ~~way~~ ~~for~~ not afraid to espouse <sup>a</sup> ~~any~~ cause  
however ~~unpopular~~, ~~at~~ ~~the~~ ~~present~~ if he believes  
it to be in the interest of freedom. ~~that~~ ~~is~~

and tolerance. ~~especially~~ ~~for~~ ~~his~~ ~~work~~ ~~the~~ ~~money~~ He lives among  
us, in humble greatness ~~of~~ ~~his~~ ~~work~~ and yet ~~close~~, ~~and~~ ~~old~~  
~~and~~ ~~great~~ ~~and~~ ~~old~~ and yet young, ~~was~~ already a  
~~dear~~ ~~and~~ ~~legend~~ ~~and~~ ~~get~~ ~~so~~  
~~simple~~, ~~and~~ ~~and~~, ~~and~~ ~~is~~ ~~an~~ ~~example~~  
~~of~~ ~~the~~ ~~power~~ ~~of~~ ~~being~~ ~~great~~ ~~and~~ ~~yet~~ ~~humble~~,

~~wise and yet~~ ~~never~~ ~~always~~ ~~leave~~ ~~a~~ ~~child~~ ~~in~~  
na