

= Einstein ? Szilárd letter =

The Einstein ? Szilárd letter was a letter written by Leó Szilárd and signed by Albert Einstein that was sent to the United States President Franklin D. Roosevelt on August 2 , 1939 . Written by Szilárd in consultation with fellow Hungarian physicists Edward Teller and Eugene Wigner , the letter warned that Germany might develop atomic bombs and suggested that the United States should start its own nuclear program . It prompted action by Roosevelt , which eventually resulted in the Manhattan Project developing the first atomic bombs .

= = Origin = =

The discovery of uranium fission in December 1938 , reported in the January 6 , 1939 issue of Die Naturwissenschaften by Otto Hahn , and Fritz Strassmann , and its correct identification as nuclear fission by Lise Meitner in the February 11 , 1939 issue of Nature , generated intense interest among physicists . Even before publication , the news was brought to the United States by Danish physicist Niels Bohr , who opened the Fifth Washington Conference on Theoretical Physics with Enrico Fermi on January 26 , 1939 . The results were quickly corroborated by experimental physicists , most notably Fermi and John R. Dunning at Columbia University .

The Hungarian physicist Leó Szilárd , who was living in the United States at the time , realized that the neutron α - β driven fission of heavy atoms could be used to create a nuclear chain reaction that could yield vast amounts of energy for electric power generation or atomic bombs . Such a reaction using neutrons was an idea he had first formulated in 1933 , upon reading Ernest Rutherford 's disparaging remarks about generating power from his team 's 1932 experiment using protons to split lithium . However , Szilárd had not been able to achieve a neutron α - β driven chain reaction with neutron α - β rich light atoms . In theory , if in a neutron α - β driven chain reaction the number of secondary neutrons produced was greater than one , then each such reaction could trigger multiple additional reactions , producing an exponentially increasing number of reactions .

Szilárd teamed up with Fermi to build a nuclear reactor from natural uranium at Columbia University , where they were fortunate in having a sympathetic head of the physics department in George B. Pegram . At the time there was disagreement about whether it was uranium α - β 235 , which made up less than 1 % of natural uranium , or the more abundant uranium α - β 238 isotope , as Fermi maintained , that was primarily responsible for fission . Fermi and Szilárd conducted a series of experiments , and concluded that a chain reaction in natural uranium could be possible if they could find a suitable neutron moderator . They found that the hydrogen atoms in water slowed neutrons , but tended to capture them . Szilárd then suggested using carbon as a moderator . They now needed large quantities of carbon and uranium to create a reactor . Szilárd was convinced that they would succeed if only they could get the materials .

Szilárd was concerned that German scientists might also attempt this experiment . The German nuclear physicist Siegfried Flügge published two influential articles on the exploitation of nuclear energy in 1939 . After discussing this prospect with fellow Hungarian physicist Eugene Wigner , they decided that they should warn the Belgians , as the Belgian Congo was the best source of uranium ore . Wigner suggested that Albert Einstein might be a suitable person to do this , as he knew the Belgian Royal Family .

The connection between Einstein and Szilárd pre α - β dates the letter . They knew each other in Berlin in the early 1920s , and in 1926 jointly invented the Einstein α - β Szilárd refrigerator .

= = The letter = =

On July 12 , 1939 , Szilárd and Wigner drove in Wigner 's car to Cutchogue on New York 's Long Island , where Einstein was staying . When they explained about the possibility of atomic bombs , Einstein replied : Daran habe ich gar nicht gedacht (I did not even think about that) . Szilárd dictated a letter in German to the Belgian Ambassador to the United States . Wigner wrote it down , and Einstein signed it . At Wigner 's suggestion , they also prepared a letter for the State

Department explaining what they were doing and why , giving it two weeks to respond if it had any objections .

This still left the problem of getting government support for uranium research . Another friend of Szilárd 's , the Austrian economist Gustav Stolper , suggested approaching Alexander Sachs , who had access to President Franklin D. Roosevelt . Sachs told Szilárd that he had already spoken to the President about uranium , but that Fermi and Pegram had reported that the prospects for building an atomic bomb were remote . He told Szilárd that he would deliver the letter , but suggested that it come from someone more prestigious . For Szilárd , Einstein was again the obvious choice . Sachs and Szilárd drafted a letter riddled with spelling errors and mailed it to Einstein .

Szilárd set out for Long Island again on August 2 . Wigner was unavailable , so this time Szilárd co - @ - @ opted another Hungarian physicist , Edward Teller , to do the driving . Einstein dictated the letter in German . On returning to Columbia University , Szilárd dictated the letter in English to a young departmental stenographer , Janet Coatesworth . She later recalled that when Szilárd mentioned extremely powerful bombs , she " was sure she was working for a nut " . Ending the letter with " Yours truly , Albert Einstein " did nothing to alter this impression . Both the letter and a longer explanatory letter were then posted to Einstein .

The letter warned that :

In the course of the last four months it has been made probable ? through the work of Joliot in France as well as Fermi and Szilárd in America ? that it may become possible to set up a nuclear chain reaction in a large mass of uranium , by which vast amounts of power and large quantities of new radium @ - @ like elements would be generated . Now it appears almost certain that this could be achieved in the immediate future .

This new phenomenon would also lead to the construction of bombs , and it is conceivable ? though much less certain ? that extremely powerful bombs of a new type may thus be constructed . A single bomb of this type , carried by boat and exploded in a port , might very well destroy the whole port together with some of the surrounding territory . However , such bombs might very well prove to be too heavy for transportation by air .

It also specifically warned about Germany :

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over . That she should have taken such early action might perhaps be understood on the ground that the son of the German Under @ - @ Secretary of State , von Weizsäcker , is attached to the Kaiser @ - @ Wilhelm @ - @ Institut in Berlin where some of the American work on uranium is now being repeated .

= = Delivery = =

The letter was signed by Einstein and posted back to Szilárd , who received it on August 9 . Szilárd gave both the short and long letters , along with a letter of his own , to Sachs on August 15 . Sachs asked the White House staff for an appointment to see the President , but before one could be set up , the administration became embroiled in a crisis due to Germany 's invasion of Poland , which started World War II . Sachs delayed his appointment until October so that the President would give the letter due attention , securing an appointment on October 11 . On that date he met with the President , the President 's secretary , Brigadier General Edwin " Pa " Watson , and two ordnance experts , Army Lieutenant Colonel Keith F. Adamson and Navy Commander Gilbert C. Hoover . Roosevelt summed up the conversation as : " Alex , what you are after is to see that the Nazis don 't blow us up . "

Roosevelt sent a reply thanking Einstein , and informing him that

I found this data of such import that I have convened a Board consisting of the head of the Bureau of Standards and a chosen representative of the Army and Navy to thoroughly investigate the possibilities of your suggestion regarding the element of uranium .

Einstein sent two more letters to Roosevelt , on March 7 , 1940 , and April 25 , 1940 , calling for action on nuclear research . Szilárd drafted a fourth letter for Einstein 's signature that urged the

President to meet with Szilárd to discuss policy on nuclear energy . Dated March 25 , 1945 , it did not reach Roosevelt before his death on April 12 , 1945 .

= = Results = =

Roosevelt decided that the letter required action , and authorized the creation of the Advisory Committee on Uranium . The committee was chaired by Lyman James Briggs , the Director of the Bureau of Standards , with Adamson and Hoover as its other members . It convened for the first time on October 21 . The meeting was also attended by Fred L. Mohler from the Bureau of Standards , Richard B. Roberts of the Carnegie Institution of Washington , and Szilárd , Teller and Wigner . Adamson was skeptical about the prospect of building an atomic bomb , but was willing to authorize \$ 6 @, @ 000 (101344 current dollars) for the purchase of uranium and graphite for Szilárd and Fermi 's experiment .

The Advisory Committee on Uranium was the beginning of the US government 's effort to develop an atomic bomb , but it did not vigorously pursue the development of a weapon . It was superseded by the National Defense Research Committee in 1940 , and then the Office of Scientific Research and Development in 1941 . The Frisch ? Peierls memorandum and the British Maud Reports eventually prompted Roosevelt to authorize a full @-@ scale development effort in January 1942 . The work of fission research was taken over by the United States Army Corps of Engineers 's Manhattan District in June 1942 . It directed an all @-@ out bomb development program .

Einstein did not work on the Manhattan Project . The Army denied him the work clearance needed in July 1940 , saying his pacifist leanings made him a security risk , although he was allowed to work as a consultant to the United States Navy 's Bureau of Ordnance . He had no knowledge of the atomic bomb 's development , and no influence on the decision for the bomb to be dropped . According to Linus Pauling , Einstein later regretted signing the letter because it led to the development and use of the atomic bomb in combat , adding that Einstein had justified his decision because of the greater danger that Nazi Germany would develop the bomb first . In 1947 Einstein told Newsweek magazine that " had I known that the Germans would not succeed in developing an atomic bomb , I would have done nothing . "