LA-UR-17-23522
Approved for public release; distribution is unlimited.

Title: Bethe, Oppenheimer, Teller and the Fermi Award: Norris Bradbury Speaks

Author(s): Meade, Roger Allen

Intended for: Internal Distribution

Issued: 2017-04-28

Bethe, Oppenheimer, Teller and the Fermi Award
Norris Bradbury Speaks

R.A. Meade, ed.

Editor's Note

In 1956 the Enrico Fermi Presidential Award was established to recognize scientists, engineers, and science policymakers who gave unstintingly over their careers to advance energy science and technology. The first recipient was John von Neumann. .[1] Among those scientists who were thought eligible for the award were Hans Bethe, J. Robert Oppenheimer, and Edward Teller. In 1959 Norris Bradbury was asked to comment on the relative merits of each these three men, whom he knew well from their affiliation with Los Alamos. Below is a reproduction of the letter Bradbury sent to Dr. Warren C. Johnson of the AEC's General Advisory Committee(GAC) containing his evaluation of each man. The letter might surprise those not accustomed to Bradbury's modus operandi of providing very detailed and forthright answers to the AEC.

The letter, itself, was found in cache of old microfilm. Whether because of the age of the microfilm or the quality of the filming process, portions of the letter are not legible. Where empty brackets appear, the word or words could not be read or deduced. Words appearing in brackets are guesses that appear, from the image, to be what was written. These guesses, of course, are just that – guesses.

[1] https://science.energy.gov/fermi

June 22, 1959

Dr. Warren C. Johnson
Division of Physical Sciences
University of Chicago
Chicago 37, Illinois

Dear Dr. Johnson:

I have your letter of May 19, 1959, asking for comments on the accomplishments of Bethe, Oppenheimer, and Teller as they might relate to their eligibility for the Fermi Award. This Award, as I understand it, is granted for "any specially meritorious contribution to the development, use, or control of atomic energy. " In my opinion each of these men might quite appropriately be granted such recognition. Of course, the men are very different and so is the nature of their very real contributions to our present position in the field of atomic energy. I shall comment on the candidates in alphabetical order.

First, Bethe. For more than two decades Bethe has made an outstanding contribution to physics, particularly nuclear physics, both through his own work and the through the fact that he has been largely responsible for the high quality of the school of modern physics at Cornell which, in the more than twenty years or so he has been there, has been one of the best in the country. His early work on carbon cycle is well known. His early [monumental] articles on nuclear physics, printed in the *Reviews of Modern Physics* in 1936 and 1937, were probably as important as any other writings in this field for the whole period of the ensuing decade. Since the war, in addition to an enormous amount of classified and applied work to which I shall refer below, he has continued to produce important articles and books as well as providing helpful criticism and advice to a wide circle of others. In this period too, special mention should be made of the enormous and favorable influence on a large group of students and younger men, including many who will be in the forefront of American physics in the next generation. Indeed, although he is unquestionably a great physicist in his own right, it may well be through his teaching, both formal and informal, that he will make his largest contribution to physics in this country.

Bethe has also been outstanding in his contributions to applied physics particularly in the field of atomic energy and particularly, although not exclusively, in problems connected with national defense. Already, before the Manhattan Project was formed, Bethe was engaged in defense work for the OSRD, [NDRL], and the wartime project at MIT, as well as in the early studies concerning the feasibility of obtaining nuclear explosions both from the fission and thermonuclear processes. His wartime work at Los Alamos, where he was in charge of the [theoretical work]required for the development of the first atomic bombs is, of course, [well known]and although his position entailed a considerable administrative responsibility, [his] direct technical contributions to the project can scarcely be over

emphasized. Following the war and continuing [for] at least until a year or so [after that], [he] devoted a great deal of time to a wide range of problems of importance [to] reactor theory. Once the early hope that atomic armaments might be controlled through the United Nations had to be abandoned, Bethe resumed his effective [participation] in the weapons program at Los Alamos. It is not generally realized, [] that he did a considerable amount work on the theory the [], and that he worked full time on this project for most of the []. His [] assistance to others engaged in that work was again of the [] and has continued to make his services available to the weapons program regularly since that time, but, of course, has become increasingly involved with government undertakings having to do with atomic energy in one form [or another]. Examples are: his chairmanship of the scientific panel which reviews foreign weapon tests, including the probable nature of atomic weapons available to foreign powers; and, [more recently], aspects of ICBM programs; work on weapons effects at high altitudes; and work connected with the problem of detection foreign nuclear explosions [] various conditions.

Second, Oppenheimer. Oppenheimer's own early work in physics, while quite distinguished, had rather little to do with atomic energy. This is probably also true of the period since the war during which he has been directing the Institute for Advanced Study in Princeton. Under his direction, of course, the school has continued to be a very important one, but in areas of concern [thought]to be on a rather high and abstract level having no easily demonstrated [relevance] with current applications. Apart from his work in Los Alamos and [] work for the Government, Oppenheimer's most distinctive contributions to atomic energy in this country was achieved through influence as a teacher [in] California in the 1930s. A large and surprisingly able group of students [attended] there for the study of modern physics, and Oppenheimer's presence was an important factor in what might [fairly] be called the flowering [of science] on the west coast. As a result, at the start of the war, there was []and able men, trained in California, who were in an excellent position to contribute to the atomic energy program.

Oppenheimer's most notable contribution to the field of atomic energy was, of course, his work at Los Alamos. Prior to the formation of the Manhattan Project, [Oppenheimer] as well as Bethe and Teller had done a considerable amount of work in [] the feasibility of obtaining explosions by the use of Uranium or []. Once the Los Alamos Project was formed, Oppenheimer, as director, was engulfed in administrative responsibilities. Under the frantic conditions which applied at the time, this was a staggering undertaking, which Oppenheimer handled brilliantly. The senior staff which he assembled has probably never been equaled in quality for a group of that size, and while this insured that the best possible attention would be available for each aspect of the work, it was Oppenheimer's responsibility and achievement that this diverse group, bristling with strongly-held and conflicting opinions, worked nevertheless, by and large, towards a single objective. Very few people could have accomplished such a harmonization, but Oppenheimer did. Following the war, Oppenheimer responded to many demands to give his advice in various government contexts on atomic energy matters. Examples are: his work on

the Lilienthal Report and his service on the first GAC. There are, of course, violent differences of opinion as to the soundness of his positions on some of the points at issue at the time. I do not believe, however, that there is any supportable question [but] that he did not devote his full energy and sincerity to the problems brought before him. It has been said that he opposed the development of the hydrogen bomb. Indeed, he did oppose a crash program on a scheme as improbable of success as the scheme then under discussion appeared to be. However, once the approach, which offered good probability of success was finally proposed in 1951, he gave his full official support to the subsequent intensive work to develop weapons based on the new principle.

Third, Teller. Although Teller is also clearly an important physicist , his accomplishments in pure physics cover a rather wide field of theoretical approaches to a variety of problems, a large number of which have not [] very directly on the application of atomic energy, and perhaps not always capable of being characterized as momentous contributions to science. Moreover, I find myself in a rather poor position to comment on those technical points from my own knowledge, and I am sure that you have available to you much more detailed information of them than I can supply. Teller, of course, has been an inspiring teacher and has exerted an important influence on an able group of younger men, particularly during the years (unfortunately rather few) in Chicago following the war. On this score, however, it is my feeling that his influence has not been as important as that Oppenheimer and certainly [not] as important as that of Bethe.

With respect to applied physics, as mentioned before, Teller, as well as Oppenheimer and Bethe, began work on the feasibility of nuclear explosions before the Manhattan Project was formed. For a year after the project in Chicago started, he did some work on problems connected with reactors. He was at Los Alamos from the beginning until after the war. His wartime work at Los Alamos was much less crucial to the development of the first atomic bomb than that of Bethe, in part because of his irrepressible interest, even at that time, in the possibility of a fusion weapon. Moved by his deep conviction that such a [weapon was] possible, Teller continued after the war to work on a wide range of problems related to thermonuclear weapons and inspired and guide a large part of the work undertaken by others at Los Alamos in that field. It is not at all correct to assume that such work here would have been abandoned except for his influence, but it is [] that his enthusiasm and his active participation added a very considerable [] and drive to the studies undertaken. Between 1946 and 1951, Teller spent a considerable fraction of his time at Los Alamos contributing to the weapons program, particularly, but by no means only, in the thermonuclear field. For example, Teller deserves considerable (though not exclusive) credit for the contribution [] of a germinal idea affecting the design of fission weapons, which [] in fully developed form, widely and effectively used. Best known, of course, is the fact that early in 1951, Teller along with Ulam, perceived the principle [] that changed the whole approach to the hydrogen bomb and changed the prospects of success from improbable to probable. Teller returned to Chicago late in 1951 about the time the,

specific design undertaken here for the first full-scale hydrogen bomb test, which occurred a year later. Since that time, his contributions to the weapons program have been made at Livermore and [] known to you. In addition to his work on weapons, for [] Teller devoted considerable time to the problems of the Atomic Energy Commission Reactor Safeguard Committee. He served for a short time on the GAC and gave much assistance to various branches of the armed forces on the problems of the effective use of atomic weapons under various conditions.

In addition to the comments above, in which I have tried to give [you] a picture of the contributions of the individuals considered, I should like to [take] this opportunity to add a few comments of a rather general nature even though I realize that there will be little about these of which you are not already [aware]. As compared to Teller and Oppenheimer, Bethe has been rather little in the public eye (as was also true of Wigner).[2] This, of course, is because he has been relatively apolitical and that, in turn, in no doubt due to the difference in temperament. So far as sustained and broad direct technical contributions to the atomic energy field are concerned, however, Bethe outranks the other two. An award to Bethe could appropriately be made on the basis of these contributions. With respect to Oppenheimer, such an award, which would also in my opinion be appropriate, would have to be made for his achievements at Los Alamos, which were largely administrative in nature. Even at this time, however, as I am sure you know, an award to Oppenheimer would have some controversial aspects, which would have to be considered. Concerning Teller, it is my opinion that a national award would almost universally and inescapably be understood to be in recognition of the invention of the hydrogen bomb. Actually, the basic first paper which outlined the approach that [subsequently] proved successful, was a joint paper of Teller and Ulam, and the patent application on the process involved was jointly signed by them. It is, consequently, [] that if an award is to be given for the hydrogen bomb, it really ought to be [an award shared by both] Teller and Ulam.

Finally, I should like to mention an other point, which I believe [you should] consider, and this is the sharp, semi-public opposition which exists and [has] for a year or so, between Bethe and Teller on the general question of a possible agreement to suspend atomic weapon tests. It would seem to be an almost inevitable and extremely unfortunate consequence of an award to either that it would be construed as appearing to give support to one or the other public opinion on this issue. I have no solution to this dilemma to propose other than the not entirely facetious suggestion that a joint award to all three individuals be made – with the additional proviso that it would be expected to make the same triply joint award for the two following years! Such a procedure would have the additional

[2] Wigner received the award in 1958.

attraction of settling this perennially onerous question until 1962! After all, these names will be coming up year after year –so why not settle the matter now?[3]

Sincerely,

N.E. Bradbury
Director

[3] Bethe received the award in 1961, followed by Teller in 1962, and Oppenheimer in 1963.