EXHIBIT A

Technical Opinions on Cyclotron Project

A letter which the officers wrote to a group of experts in this country and Europe, seeking their advice on this proposal, contained the sentence: "The Rockefeller Foundation would hardly be justified in granting a sizable sum toward this very large and expensive project unless the expert opinion of the world of science is reasonably unanimous in viewing this as constituting one of the most interesting, the most potentially important, and the most promising projects in the whole present field of natural science." The following quotations cover the entire list of the answers received.

President Karl T. Compton, Massachusetts Institute of Technology

"I not only consider Professor Lawrence's cyclotron project as 'one of the most interesting, the most potentially important, and the most promising projects in the whole present field of natural science', but I should definitely place it in the number one position by a large margin among the various scientific projects of which I have knowledge at the present time."

"****no one could possibly question the selection of the University of California and Ernest Lawrence as the institution and the scientist to whom the project should be entrusted.

"If a large cyclotron project is sponsored by the Foundation, I hope that the appropriation will be large enough to permit Lawrence to build a cyclotron of sufficient energy for reasonable expectation of producing mesotrons. As I understand it, this would require 160,000,000 electron volts or a little more. If a cyclotron smaller than this were to be built and were to operate successfully, there would be an immediate regret that it had not been made enough larger to produce mesotrons and investigate the very significant phenomena disclosed in cosmic ray studies and described as 'showers' or 'bursts'."

"It seems to me, therefore, that both ultimate economy and good judgment call for consideration of a cyclotron large enough to work in the mesotron range."

Dr. Vannevar Bush, President, Carnegie Institution of Washington

"I have not the slightest hesitancy in replying immediately with my personal comments in regard to your letter of February fifteenth on the proposed cyclotron. The matter is fresh in my mind, for the Institution made a considerable study of the whole cyclotron subject before embarking on its present program for a moderate size unit in the Washington region. We decided to go ahead when we were convinced that the opportunity for further biological and medical progress in a number of institutions hereabout was so great that the opportunity should not be missed even in a period of restricted funds. I have also had many conferences with scientists and others interested in Ernest Lawrence's present plans for a large instrument. Out of this have emerged a number of clear convictions in my mind.

"In the first place, I have never seen a project advanced which secured the enthusiastic support of scientific individuals to the extent that this one has. This is partly, it is true, due to Ernest Lawrence's fine personality, and more specifically to the generous way in which he has furthered the efforts of other individuals all over the country, sometimes at considerable self-sacrifice. It is due also, I feel, to the inherent enthusiasm for the project itself."

"One question which immediately arises is of course the feasibility of the project from a scientific standpoint. *** Personally I have not the slightest reservation in this regard ***.

"The next question is, of course, whether the results probably attainable with such an instrument would warrant the expenditure involved. If the new instrument were simply to do more rapidly the things which are done at the present time, to produce materials in greater quantity, then I might indeed hesitate. The situation appears, however, to be entirely different, for the new instrument is expected to open up regions of exploration which are not merely more extensive but essentially different in nature. The fragmentary information obtainable as to what lies therein, obtained from cosmic rays, is so striking that I feel personally that an exceedingly strong effort to enter this region under controlled conditions is fully warranted. There will, of course, be some discussion as to how great the effort must be, specifically how large the equipment should be constructed, in order to be sure of crossing the boundary into really new fields. I am not inclined to attempt to speak with authority on this particular matter. I do feel, however, that if there is doubt, a sufficient effort should be made to be reasonably sure that the boundary can be crossed with a factor of safety. My impression is that Lawrence has estimated this particular matter in a reasonable way after having secured the comments and criticisms of physicists who really are qualified to judge in detail of what is necessary.

"One can never be sure, of course, that a courageous project of this sort will be successful. *** All such steps are bound to be gambles

to a certain extent. I feel, however, that this opportunity is the most interesting, the most potentially important, the most promising project of large magnitude in the whole field of the natural sciences. I feel, moreover, that there is sufficient promise that it will be of striking effect upon the progress of allied sciences, so that it has a dual appeal, first from the standpoint of pushing forward the forefront of knowledge in the field of physics, and second of lending its aid to the present striking trend of progress in the biological sciences due to the impact of new instrumentalities and materials from the physical field."

Dr. Frank B. Jewett, President, Bell Telephone Laboratories; President, National Academy of Sciences

"****it seems evident that the results to be expected from the 2,000-ton apparatus are a matter of engineering calculation and not one of uncertain speculation.

"The value of an apparatus capable of producing atomic projectiles of more than 100 million volts energy is of course beyond question. Both in the domain of physics, where an entirely new experimental examination of the nucleus of the atom would be made possible, and in the domains of medicine and engineering where collateral applicational results of immense importance to society may follow, the value of such an equipment can hardly be exaggerated. The step from 10 million volt particles to those having energies of 100 to 200 million volts is so great that the new tool and the results to be expected from its use are of an entirely different kind from anything we now possess. It should open up entirely new and at present unknown territory.

"The building of such a device is a matter of importance to all of us and not merely to those connected with the institution where it is located or to the community or state in which that institution exists."

"As to the availability of any cyclotron which may be constructed for general use by competent scientists, and as to the likelihood that Professor Lawrence, given the necessary funds, can in all probability produce the physical results he anticipates, little or nothing need be said. His successes in the past have been such as to give every ascertainable assurance of success in the future. As a matter of fact I think there is probably no one in the world in position seriously to question his conclusions."

Dr. W. D. Coolidge, Director of Research, General Electric Company

"To use the language of your letter of the 25th, I do view the proposed cyclotron for 100 million volt single charged particles, to be built by Professor Ernest O. Lawrence, 'as constituting one of the most interesting, the most potentially important, and the most promising projects in the whole present field of natural science'.

"I have discussed your letter with Drs. Albert W. Hull and Irving Langmuir, and they feel just as I do about it."

Dr. Lee A. DuBridge, Professor of Physics and Dean of the College, University of Rochester (Professor DuBridge is, next to Lawrence, one of the most successful operators of a cyclotron research program.)

"****I want to say in all sincerity that I do believe that Lawrence's project is one of the very most important in the whole field of physics. I base my view on three counts:

"The project is feasible."

"Professor Lawrence himself deserves full support."

"The project itself is of greatest importance."

Professor Arthur H. Compton, University of Chicago

"If anyone can make a success of a 2,000 ton cyclotron, Lawrence is the man. He has shown the organizing ability, the technical skill, the scientific imagination, and the cooperative spirit which will enable him to get the most out of such an instrument.

"I agree with him, likewise, that in the study of the atomic nucleus lies at present the most important direction of advance in physics."

"Because I do not see how such results can be obtained unless some foundation such as yours undertakes the project, I hope that you may find it possible to give Lawrence the support which he requests."

Professor A. L. Hughes, Washington University, St. Louis (Professor Hughes is an able and highly respected physicist, who spent several months, last year, making a careful study of the whole cyclotron situation.)

"My delay in answering your letter has not been due to any doubt in my mind as to the advisability of supporting Dr. E. O. Lawrence's plans for a giant cyclotron weighing several thousand tons, but to a desire to formulate more definitely the reasons why I consider the project to be eminently worth while.

"Of all the fields now investigated by physicists, I believe that the study of the nucleus holds out the richest promise of great returns. Among the tools for research in nuclear physics, the cyclotron has gone so far ahead of its rivals that I consider it the equipment par excellence for work in this field."

"Granted that the project is a worth-while one, the next question is to whom should it be entrusted. Dr. Lawrence's experience in this field is so great that there is no question in my mind but that he is the obvious person to undertake this gigantic project. I have visited many cyclotron centers, including two visits to Berkeley, during the last eighteen months. Berkeley is far ahead of all its rivals. I don't believe that there is a group anywhere in the world of physics today to compare with Lawrence and his associates. Lawrence has to an unusual degree the vision to make a success of a complicated undertaking such as the proposed cyclotron project must be and the ability to organize a group of specialists so as to get the best out of them.

"I realize that the project is far more costly than any other single project which physicists have attempted to undertake in the past, but I believe that the results obtained with the 184-inch cyclotron may be as important to physics as the results obtained with the Mount Wilson 100-inch telescope have been to astronomy."

Professor Frederic Joliot, Laboratoire de Chimie Nucléaire, Collège de France, Paris

"Je suis personnellement convaincu que la réalisation d'un tel appareil est susceptible d'apporter des résultats considérables dans la connaissance du noyau des atomes et des propriétés des particules lourdes de très grande énergie.

"Le Professeur Lawrence est, sans aucun doute, l'homme le plus qualifié pour entreprendre cette construction. D'autre part, la présence de nombreux techniciens de valeur de votre pays, et les moyens puissants qui s'y trouvent, sont un gage de succès."

Professor M. L. E. Oliphant, Department of Physics, University of Birmingham, England

"I thank you for your letter of January 25th concerning the question of construction of a very large cyclotron by Professor E. O. Lawrence of Berkeley, California. In my opinion it is essential that the construction of the cyclotron should be carried to the limit by Professor Lawrence, as he and his school alone have sufficient experience of this apparatus to enable an extrapolation of present working conditions to be carried out with any confidence. It is essential that charged particles should be available for physical investigation with energies above 50 million volts, and I can see no hope that these will be obtained in any other way than by

use of the very elegant method worked out so successfully by E. O. Lawrence. It is particularly necessary that criticism of these schemes on theoretical grounds should not be allowed to hold up the project. Had Lawrence listened to such criticisms in the past he would never have attempted the construction of the 60-inch cyclotron, and I am quite sure that his ideas of overcoming the effects of relativis-tic increase of mass are above suspicion, and cannot fail to yield results.

"From the practical point of view the construction of a gigantic cyclotron of the type suggested is the next move in the attack of Science upon the nucleus. *** I very much hope that The Rockefeller Foundation will view this project sympathetically, for it is certain that the opinion of practical men of science will be that it is the most interesting, and potentially the most important, of the present projects in the field of natural science."

Professor Niels Bohr, Institute of Theoretical Physics, University of Copenhagen

"I thank you for your kind letter of January 25, from which I learned with the greatest interest about the plans of Professor Lawrence to build a cyclotron of giant dimensions permitting the production of ion beams with energies above 100 million volts. Such an instrument would indeed create a new source of information about the properties of atomic nuclei of a kind unaccessible by present means. *** Surely, it would be greeted with outmost (sic) pleasure by all physicists, if means could be raised to allow Professor Lawrence to use his unique ingenuity and experience to undertake this great adventure, the success of which would crown his marvellous achievements in this field in a most appropriate manner.

"In this connection I cannot omit to emphasize the extreme generousity with which Professor Lawrence has put his costly time and energy at disposal for laboratories all over the world where cyclotrons have been built,and where without his invaluable advice success would have been difficult if not impossible to obtain. Of course all these cyclotrons will in no way lose their value by the creation of such a super structure. On the contrary a division of labour and of research programms will in nuclear physics be at least as important as in other fields of science, and the smaller cyclotrons will for a long time be indispensable not only as a source of radio active products for biological experiments, but also as a means of carrying out many physical researches, for which the extreme energies will not be required."