EXPERIMENTS ON THE PRODUCTION OF HIGH VELOCITY IONS BY IMPULSE METHODS

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EXPERIMENTS on the impulse methods of producing high velocity ions were undertaken with a two-fold purpose: first, if possible, to improve and make more practicable the technique already in use at the University of Virginia for accelerating ions by impulse methods to very high energies, and second, with this accomplished, to use the high velocity ions in nuclear studies.

As stipulated in the application for the grant of $2,500, it has been used for technical assistance. Starting in September, 1935, Dr. L. B. Snoddy has been paid $250 per month, or a sum of $2,000 to date. The remainder will be paid to Dr. Snoddy by the end of June. All equipment and supplies have been furnished by the University of Virginia, and this institution has also given a fellowship each to Dr. W. T. Ham, Jr., and Dr. H. Trotter, Jr., who have assisted with the problem.

The impulse method as we use it produces the high velocity ions by effectively moving the accelerating electrical field with the same speed as the ion. As a result the maximum velocity attainable, at least theoretically, depends upon the length of the tube through which the ion is made to move.

The principal new development required in this technique is obviously a suitable method of moving the electrical field along a tube with the same speed as the ion. In our work last year we used the well-known artificial transmission line to move the field and obtained protons with energies in excess of 2×10^6 electron volts. However, to obtain much higher energy protons than this, the tube became too long for the average laboratory room. (For heavy ions this limitation does not always exist.) Therefore we have set ourselves the task of devising a transmission line that will solve this difficulty. Some of the difficulties of constructing such a transmission line will become apparent when one realizes that

the wave front of the electrical impulse must not be appreciably flattened and that it must be timed with the ion (proton) beam to better than 10^{-8} sec. Even before we were able to study the behavior of the above type of line, it was necessary for us to improve our cold cathode gas focused cathode ray oscillograph until it would resolve approximately 10^{-9} sec. Furthermore, we now find it highly desirable to obtain still higher time precision and so an oscillograph embodying fundamentally new features has been designed and at the present time is almost ready for use.

It is our view that this impulse method should have its maximum value in the production of ions with energies in excess of that possible to produce by other methods. As a result, up to the present time, we have concerned ourselves entirely with the development of technique. A large number of different types of lines have been constructed and tried out on the tube. While as yet we have not completely succeeded in constructing a transmission line ideal for our purpose, we have very much improved our old one and believe that we have collected the information required to solve this problem. It is hoped that in the near future we shall be able to report in detail upon the solution of our problem in technique as well as its use, probably in some preliminary nuclear study.

UNIVERSITY OF VIRGINIA,
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RESEARCH ON METEOR TRAINS

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Work on this problem was started in September, 1935, on the arrival of Dr. C. H. Cleminshaw, whose subsequent time has been spent upon its prosecution. Largely through his efforts, though partly through those of the undersigned, both data and articles bearing upon the subject have been discovered in this country, and some have been sent to us from abroad. We have obtained many old records and had