activity was observed from all the other substances, but at least a large component of the effect, seemed to have a half life of 10 minutes, which would lead one to suspect that it was due to carbon contamination on the surface of the targets. A closer investigation of their rates of decay will help to decide whether or not carbon is responsible for the whole effect.

We wish again to express our gratitude to the Seeley W. Mudd Fund, through which this work was supported.

H. R. CRANE
C. C. LAURITSEN

Kellogg Radiation Laboratory,
California Institute of Technology,
March 1, 1934.

A Method for Investigating Electrical Breakdown Processes

The ordinary methods of studying spark gap and related types of electrical discharges depend upon the Kerr cell, the rotating mirror, the cathode-ray oscillograph or the use of travelling waves in some type of transmission system. In the Kerr cell and rotating mirror methods luminosity must appear in the gap before any information can be obtained. This luminosity appears after the breakdown process is at least partially completed and it is consequently difficult or impossible to determine the initial conditions of the discharge. The other two methods obviously can yield only information concerning the potential and current-time relations.

The method which we are now using enables us to study the processes occurring before the appearance of luminosity and to obtain the ion distribution before breakdown has been completed. It consists in producing the discharge in a Wilson cloud chamber and was suggested in principle by Professor J. W. Beams. This of course has the disadvantage that the processes must be investigated in an atmosphere saturated with water vapor but for a study of breakdown mechanism this is relatively unimportant.

The circuit which is in use is designed to give voltage impulses of the shortest possible duration. The impulses are applied to the end of a short two-wire transmission line from a condenser spark gap circuit. The sending end of the line is shunted by a second gap arranged so that it is about 30 percent overvolted and also irradiated by ultraviolet light from the first gap. The duration of the voltage impulse applied to the line corresponds consequently to the time taken to build up the voltage across the shunted gap plus the time necessary for the gap to break down. Since this gap is overvolted and at the same time irradiated its time lag is very short. The total duration of the impulse is certainly not over 10^{-7} sec. The cloud chamber is placed at the terminal end of the line which is six meters in length. This end is terminated by the characteristic impedance of the line to prevent reflections. The expansion of the chamber is synchronized with the electrical system by using a third gap energized from a separate transformer to start the discharge in the supply circuit by means of ultraviolet irradiation. The time of the irradiation can be adjusted with respect to the time of expansion. It is perhaps needless to state that great care has been taken to prevent any extraneous voltage impulses from occurring on the transmission system.

For our preliminary work we have used as electrodes a steel needle and a 1/8 inch brass rod rounded to hemispherical shape at the end. With the needle negative the ion cloud is cone shaped, and rather uniform in appearance, with the apex at the needle. Its length is variable sometimes extending the entire distance between the electrodes and sometimes only a part of the distance. It is relatively easy to obtain, appearing on 80 percent of the discharges. With the needle positive the appearance is decidedly different. The discharge is in the form of single streamers usually multiple in number. They have the appearance of single particle tracks but as yet their exact nature has not been determined. They are, however, due to the field as they never appear without the voltage impulse. They are relatively difficult to obtain and are very sensitive to voltage change, a slight increase in voltage producing a diffuse cloud throughout the chamber of no very definite shape.

This study is being continued with electrodes of various geometrical arrangements and with the chamber in a magnetic field, etc. The method is also applicable to the study of breakdown over surfaces and some experiments of this kind are in progress. We believe that it will give information that can be obtained by no other known method.

L. B. SNODDY
C. D. BRADLEY

University of Virginia,
Rouss Physical Laboratory,
March 3, 1934.