ultrasonic waves of high intensity which develop higher frequencies and enhanced absorbtion as they progress.

* Supported by contract with the Office of Naval Research.
1 Hubbard, Fitzpatrick, Kankovsky, and Thaler, Phys. Rev. 74, 107–108 (1948).
2 Hubbard, Larkin, and Zartman, Radiation Laboratory, Johns Hopkins University, Report C. F.-764 (1947).

A Suggested Mechanism for the Generation of Thunderstorm Electricity

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IN October 1946 the authors undertook laboratory investigations of the electrical properties of water and ice with the hope of discovering a physical process for the development of thunderstorm electricity which would be consistent with what is now known about thunderstorms.[1]

Initial tests reported to the sponsors in January 1947 showed effects wherein large differences of potential were developed between the liquid and solid phases of water when rapid freezing was in progress. These investigations were interrupted and work was not resumed until early 1948.

In continuing, attention was first directed toward determining whether our earlier observations were related to the phenomena reported by Dinger and Gunn wherein observations suggestive of the same phenomena were interpreted as contact potential differences of from 6 to 10 volts.[2]

The authors, using apparatus similar to that of Dinger and Gunn, were able to obtain relatively larger electrical effects, but having such differences in sign, magnitude, and character as to indicate a different interpretation than that of contact potential. In further tests samples of relatively pure water (resistivity about 10^6 ohms-cm) were frozen in a small nickel-plated copper dish floated on a mercury pool at about -16°C. The cup was grounded and the surface of the water was connected to an electrometer through a platinum wire. As soon as a thin film of ice separated the water from the cup, the electrometer indicated a negative potential which usually increased to about 40 volts. Occasionally values of -90 volts were obtained. Frequently, a reversal in potential was observed as the freezing approached completion. These potentials varied in magnitude, but 20 or 30 volts was expected. The measured resistivity of the remaining water was less during the reversed polarity phase than that of the sample before freezing started.

When water samples of one-tenth the resistivity (contaminated with sodium chloride) were used, a positive, instead of negative, potential developed as the ice covered the metal cup reaching a maximum value of something like 25 volts. For water of intermediate conductivity (4×10^5 to 8×10^5 ohm-cm) little or no electrical activity was observed.

Amounts of charge transferred during the freezing process were determined by measuring voltage across an electrometer shunt (5×10^6 ohms). As much as 30,000 e.s.u. per cc of water was common in the low resistivity cases.

Other tests including the impingement of water drops on cold ice in a cold chamber indicated that this process appears to satisfy the requirements for the initial electrification in thunderstorms. Water drops in the low resistivity range caused the ice to become negatively charged as the drops sheared and partially froze on the ice surface; the residue of the drops leaving the ice after impact was positively charged. After the ice was warmed by continued dropping to the extent that the drops no longer partially froze, successive drops drained negative charge from the ice by the process of charge sharing. This, or a similar process of cycling, appears necessary in a thunderstorm for consistency with field observation, showing that the negative charge center does not descend much below the zero isotherm. Our limited information on the resistance of water from melted hail gives values consistent with the negative ice and positive water situation.

A more complete report giving definite information bearing on the nature of the effects here reported is in progress, and further applications to possible thunderstorm formation will be discussed.

1 This work has been supported by the Signal Corps of the United States Army.
2 J. E. Dinger and Ross Gunn, Terr. Mag. 51, 477 (1946).

Preparation and Radiation of U^{237}

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LITERATURE contains very little information about the uranium isotope U^{237}. Only the half-life, 6.5–7 days,[1,2] and the upper limit of the β-spectrum, 0.26 Mev,[2] are reported. Starke[3] pointed out the possibility of using the Szilard-Chalmers reaction for the concentration of U^{237}, obtained in the process $U^{238}(n,2n)U^{237}$. We have modified the method[4] used in earlier experiments[5] on U^{239} and Np^{239}, carried out in this institute, for the case of U^{237}.

Solid uranyl salicylaldehyde-orthophenylenediimine[6] was shielded by boron and cadmium and irradiated with fast neutrons from lithium, bombarded with deuterons in the

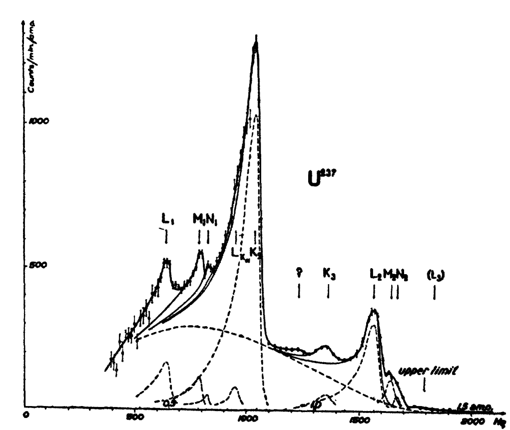

FIG. 1. The β-spectrum of U^{237}.