SOME STUDIES OF THE STARK EFFECT

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ABSTRACT

The Stark effect with parallel plates.—A method is described for obtaining the Stark effect by using a long, thin cathode, the discharge being constricted between two parallel plates. The advantage derived in greatly increased light-intensity is found to be discounted by difficulties of construction, of sputtering, and especially of proper focusing. The Stark effect obtained was of about the same order as that for a Lo Surdo tube having diameter equal to the distance between the parallel plates.

An improved type of Stark tube using positive rays is described. The cathode is a long, perforated, hollow cylinder, along the axis of which the auxiliary electrode is placed. The canal rays between these two electrodes are subjected to the electric field. This type of tube can be made to yield as great a depth of light as desired, thus giving greater intensity than the ordinary Stark tube, and affording some possibility of obtaining the Stark effect by absorption for hydrogen and helium.

The Stark effect for the zinc triplet $1s-1p$ was thoroughly studied under fields from 30,000 to 40,000 volts per centimeter, and with dispersions ranging from 10 to 4 A per millimeter. The Stark effect, if any, was found to be negligible. Nagaoka's positive results are apparently due to the pole effect. Preliminary results for the similar $1s-1p$ triplet of cadmium and the thallium line $1\pi-1\sigma$ (5350.5 A) also show no appreciable Stark effect.

I. INTRODUCTION

With the theory of the Stark effect quite fully developed, interest therein has considerably waned, although many quite important problems still remain unsolved. For instance, Kramers' theoretical article[1] is still only very partially verified by experiment; the Stark effect in metals has not been fully explored, although it can help much in classifying the spectral lines into series;[2] the Stark effect by absorption has only been touched upon by Ladenburg;[3] the Stark effect could be used to determine how long it takes the electron in the hydrogen atom to get into its perturbed orbit, etc.

It was to prepare the way for the solution of some of these problems that the experiments mentioned in this article were undertaken.

II. THE STARK EFFECT BETWEEN PARALLEL PLATES

1. PURPOSES OF EXPERIMENT

The conditions under which the Stark effect can be obtained are quite stringent, and the intensity of the light is generally rather

[1] *Zeitschrift für Physik*, 3, 199, 1920; Foster, *Physical Review*, 23, 667, 1924.

[2] Nagaoka and Sugiura, *Japanese Journal of Physics*, 3, 45, 1924.

[3] *Zeitschrift für Physik*, 28, 51, 1924.