THE SPECTRUM OF LIGHTNING.

By Philip Fox.

Spectra of lightning flashes were photographed on the nights of July 16, 17, August 3, and October 6 by means of an objective-prism spectroscope. The camera lens was of 35 mm aperture and 274 mm focal length. The 30° flint-glass prism was from a large spectroscope loaned to the Observatory by the Massachusetts Institute of Technology. Of the dozen plates showing spectra the best was obtained on August 3 at 9h 10m in the evening, and shows three flashes. They are reproduced herewith (Plate IX). The original negative is on a Cramer Isochromatic plate.

Vogel and Lohse,¹ and Schuster² identified certain lines in the lightning spectrum with lines of the spark spectrum of air. Following the suggestion of their work, the spectroscope was provided with a slit and collimator, and the air spectrum, obtained by passing a spark between silver terminals, was photographed. The agreement in position of the lines is shown in Fig. 1. The wave-lengths of the lines, with their identification, are given in the table, which also shows the wave-lengths of lines as determined by Vogel and Lohse, Schuster, and E. C. Pickering.³ Lieutenant Herschel⁴ also identified some of the lightning lines, the principal one probably being that at \( \lambda 5003 \) of the present determination.

² Phil. Mag., (5) 7, 316–321, 1879.
³ Harvard College Observatory Circular No. 62.
⁴ Proc. R. S., 17, 61, 1869.
The letter s indicates the lines used as standards in deriving the formula for wave-lengths. The higher power used in the microscope magnified about fifteen times, the lower about three times.
In studying the spectra some curious facts were observed. The relative intensity of some lines with regard to their fellows is found to vary in different parts of the spectrum. In the first flash, the line at $\lambda 4349$ diminishes rapidly in relative intensity from the cloud to the ground. The line, a combination of $\lambda 4074$ and $\lambda 4106$, at the top of the flash is one of the heaviest lines, being much stronger than its two neighbors to the left, $\lambda 4041.5$ and $\lambda 3997$. Toward the ground, however, it has lost greatly in relative intensity, having been surpassed by both $\lambda 4041.5$ and $\lambda 3997$. These two have increased from very faint lines to rank among the strongest.

In comparing the first flash with the second, it is found that in the second these same changes do not exist. The only case of change in relative intensity is shown by the line at $\lambda 4439$, which increases slightly toward the ground.

The third flash, which was at the very edge of the plate, shows the line at $\lambda 3848$ very strong, while in the other flashes it is comparatively faint. This flash shows a line far to the violet of $\lambda 3848$.

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Spectrum of Lightning Flashes.