ART. XXXIX.—*On the Spectrum of the Corona*; by W. T. SAMPSON, U. S. N.

SO FAR as I can learn from the daily papers, there seems to be a considerable unanimity of opinion as to the nature of the light of the corona. My observations, made at Separation, with Prof. Newcomb, lead me to a somewhat different conclusion from those above referred to; I therefore ask leave to describe my work.

Like many other observers of the eclipse I had set myself the task of determining the source of the light of the corona; and this I *attempted only* so far as to decide by the presence or absence of dark lines in the spectrum of the corona, whether the light was the reflected light of the sun or due to the self-luminous material, or whether it was due to both these combined. For this work I used a direct vision five-prism spectroscope, made by Browning, attached to an equatorially mounted telescope of $3\frac{1}{2}$ inch aperture and about five feet focal length. In addition I had prepared to use a hand polariscope consisting of a double-image prism and mica plate. These were the best tools for the work at my command. A few days before the eclipse Mr. Lockyer asked me, if time permitted, to examine with a radial slit whether the 1474 line came close down to the sun's surface or broke off some distance above it. Previous observers were somewhat at variance as to the fact

and upon it seemed to depend the simple or compound nature of the gas emitting the green light. I therefore determined to commence my work by adjusting the slit tangent to the disappearing limb of the sun at the beginning of totality in order to witness the reversal of the Fraunhofer lines, so admirably seen by Prof. Young in 1870, but not visible to some observers who looked for them in 1871. I proposed to look particularly for the 1474 line with the slit in this position and then to place it radially to see if the line thickened as it approached the sun's surface. The remainder of the time was to be devoted to the dark lines of the coronal spectrum and to the polariscope. I was fortunate in securing the services of Dr. Dewitt, M.D., U.S.A., to direct my telescope. During two days we practiced upon the changes and adjustments I had decided upon making during totality. By practice upon bright clouds, the sky and the moon, I decided that I could open the slit to .1 mm. while searching for the dark lines. All previous observers had described the continuous spectrum as faint. It was therefore necessary to use a slit as wide as possible and at the same time be certain of seeing the lines. As totality approached we adjusted the slit carefully tangent to the narrow crescent of the sun. The slit plates had previously been covered with white paper to secure a distinct image of the corona at the focus of the objective. The telescope of the spectroscope was clamped so as to have the spectrum from about C to F in the field. Placing my eye at the telescope in time to get the last glimmer of the solar spectrum, I was greatly surprised an instant after at the brilliancy with which the bright lines appeared, flashing out at once to their maximum brightness. The time during which this beautiful sight lasted was not sufficient for me to positively identify the lines; yet their familiar grouping left no doubt in my mind that they occupied the places which a moment before had been occupied by the dark lines of the solar spectrum. The continuous spectrum of the sun entirely disappeared before the bright lines made their appearance. I could not estimate the number of bright lines that were in the field during the probable two seconds they were visible, but they were very numerous and the impression left upon my mind was that their brilliancy corresponded to the darkness of the same absorption bands in the solar spectrum. From its brightness and position I am confident I saw the 1474 line. When this brilliant line spectrum vanished, no lines either dark or bright were visible, but a continuous spectrum held its place. I did not notice any continuous spectrum while the lines were visible.

As previously arranged the slit was placed radially, still nothing was visible but a continuous spectrum, not bright.

The slit was at this time open .02 mm. to which it was set before the eclipse began. The spectroscope was now rotated 90° and the slit opened to the division of the screw-head previously decided upon. The spectrum was then much brighter than I had anticipated. I directed my assistant to move the slit gradually away from the sun through the brightest part of the corona. This was done until the spectrum disappeared, when it was moved back again. The spectrum being so bright I directed the slit to be partly closed. I do not know how wide it was during the latter part of my search and omitted to examine it after the eclipse, but I estimate that it was not more than .05 mm. The image of the corona on both sides of the sun, east and west, was caused to slowly move over the slit, yet no trace of a break in the continuous spectrum was visible. Though the spectroscope was adjusted for sharp definition of lines between C and F, I repeatedly swept over the whole length of the spectrum. I am confident that if the dark lines had approached in distinctness those of the solar spectrum they could not have escaped my attention, which was continued to the end of totality. Two minutes at least was devoted to this search. The conclusion therefore forces itself upon my mind that the light of the corona is not all reflected light. Several considerations I think lead to this conclusion. Until this eclipse no observer has ever seen the dark lines in the spectrum of the corona except M. Janssen, who reported dark lines, notably D in 1871, but much more difficult to see than the bright lines. Several observers during the recent eclipse failed to see the dark lines, though they looked for them carefully. While I do not question the results of observers who report the presence of dark lines I think all the observations taken together show that the continuous spectrum of the corona is not the spectrum of the sun. Aside from this, Prof. Arthur W. Wright made measurements of the polarization of the light of the corona, the first time I think it has been attempted, and has found the polarization to be but a small percentage of the whole light emitted. Although all reflected light does not reach us as polarized light, yet I think the small percentage of polarization taken with the faintness of the dark lines indicates that the corona is to a considerable extent self-luminous. The meteoric dust not only reflects the sun's light but it is continually showering upon the sun and in its passage through its atmosphere is rendered incandescent.

No photographs of the spectrum of the corona can probably throw any light upon the matter.

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